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COMMENTS ON THE NEWS OF CHEMICAL ENGINEERING IN INDUSTRY

Volume 55 | FEBRUARY • 1948 | Number 2

Few chemicals, other than fertilizers and fuels, will go to western Europe in Marshall Plan cargoes. Instead Europe will purchase chemicals here with dollars it has left after more urgent needs are met. Western Europe was not in 1947 a principal buyer of chemicals produced in the United States. Total chemical exports to western Europe last year were about $150 million.

Fertilizer nitrogen gets high priority in Europe's 1948 plans to purchase chemicals here. It looks as though about 70,000 tons of nitrogen will go to western Europe from America.

Other chemical items that western Europe would like to buy here in 1948 include $160 million worth of coal tar products, medicinals and allied chemicals; $50 million worth of industrial chemicals; and $40 million worth of paints and pigments. But Europe's dollar famine means that these requirements will be substantially lowered.

•

Know-how on the Raschig process for synthetic phenol manufacture is now available. Licenses on the process can be had on a royalty-free, nonexclusive basis from the Office of Alien Property in the Department of Justice.

•

Department of Justice, through the Office of Alien Property, seeks to kindle industrial competition by license grants on more than 6,000 patents now held by 25 corporations in which the government has seized controlling stock interest under the Trading With The Enemy Act. Included are valuable patents in dyestuffs, photographic, chemical, pharmaceutical, mechanical and textile fields.

Licenses will go to applicants at reasonable terms. Ordinarily, the company holding the patent will grant the license. But if the company balks, as some may, Office of Alien Property will accept the license application.

Most patents are German, acquired by companies when they were German-controlled. Making the patents available to all comers will preclude, Department of Justice hopes, new cartel arrangements between the involved American companies and their German counterparts.

Office of Alien Property will keep its eyes peeled to see that licensing of foreign patents is actually promoting competition and not strengthening the position of already entrenched companies. A license will not be granted if, in the opinion of the Attorney General, the grant of a license prejudices competition in the field.

•

Jersey Standard group contemplates building a commercial synthesis plant to make gasoline and byproducts from natural gas. But Jersey Standard's high command hems and haws over current high construction costs.

•

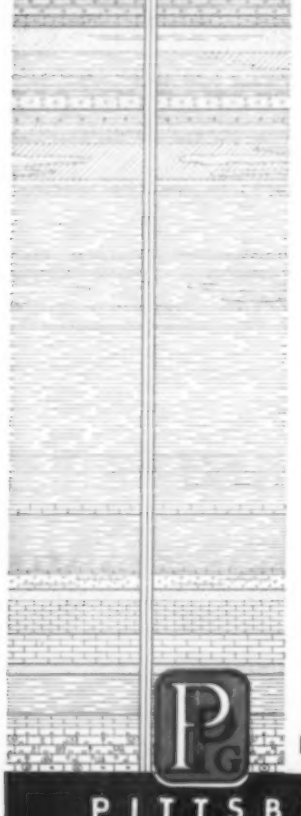
United States has turned its back on the Middle East as a source of oil and petroleum products in an emergency. Instead the government wants plants built to make synthetic fuels from natural gas and coal. Proposed synthetic plants would add as much as 40 percent to the nation's present petroleum refining capacity.

Defense Secretary James V. Forrestal, appearing before the House Armed Services Committee in January, called for immediate development of a synthetic fuels industry that could turn out 2 million barrels a day. This compares with the 5.3 million barrels a day that the United States petroleum industry now produces. Cost of the job Forrestal proposes would be $8 billion.

Interior Department is already working with the military on an initial program that would have three 10,000-barrel-a-day plants in operation by 1950. These plants would be in addition to private plants now scheduled to start producing 14,000 barrels a day late this year.

Unrest in the Holy Land makes an oil "pipeline" that stretches the length of the Mediterranean look

Obtaining salt brine from this depth was a pioneering development which presented numerous problems. All have been solved to assure successful operations.



Chlorine and Caustic Soda

from the world's deepest salt wells

The deepest salt bed in commercial use—6,800 feet below the earth's surface—provides the brine used at Columbia's electrolytic chlorine-caustic soda plant at Natrium, West Virginia. Hot water, pumped down to this great stratum, dissolves the rock salt and forces the brine to the surface.

The favorable location of the Natrium plant was established as a result of pre-Pearl Harbor studies by Columbia. Built and operated for the DPC, its post-war purchase by Columbia assured continued operation so helpful in meeting the urgent needs of industry for caustic and chlorine. The caustic soda is purified by a patented Columbia process to meet exacting uses such as required in the manufacture of rayon.

Pittsburgh Plate Glass Company, Columbia Chemical Division, Pittsburgh 13, Pa. District Offices: Chicago, Boston, St. Louis, Pittsburgh, New York, Cincinnati, Cleveland, Minneapolis, Philadelphia, Charlotte, San Francisco.

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PITTSBURGH PLATE GLASS COMPANY

mighty tenuous to the top brass. Another factor is price. Price of crude climbed faster last year than the price of natural gas. A year ago gasoline from natural gas cost 2 to 4c. a gal. more than gasoline from crude. But Jersey Standard now says it can make and sell synthetic gasoline at a competitive price.

Who is going to finance the synthetic plants? This is the $64 question. If crude prices drop, synthetic gasoline may not be able to compete in price with gasoline from crude. Government may subsidize the infant synthetic fuels industry by a tariff to keep synthetic production going in the event of falling crude prices. With such a guarantee, private capital might underwrite the program mapped by Forrestal. Otherwise, there is a good chance that the government may go into the synthetic fuels business, with military petroleum experts having a big say. Synthetic fuels might be set up like synthetic rubber. Government would be in another chemical industry, not only with a big security interest but also with a large financial and management stake.

•

Two small Texas enterprises long on vision have teamed up to turn pecan shells into dollars. In the only plant of its kind in the country, J. R. Fleming & Co. at Weatherford, Tex., extracts tannin from pecan shells. Then the spent shells are shipped to Lufkin, Tex., where the Lufkin Pecan Shelling Co. in another unique plant makes pecan shell flour out of them. The flour, 150-mesh in fineness, is sought by plastics and other industries as a filler and extender. One buyer is Bakelite.

•

Viscose rayon was made from straw in Germany's most modern rayon plant, the Phrix works at Wittenberg, built in 1938. How this plant was built and operated is shown in "Birth of a Rayon Staple Fiber Plant," one of the few German technical films brought back to the United States by OTS investigators.

•

Aromatics and unsaturated hydrocarbons will be coming from the Winnie, Tex., plant of McCarthy Chemical Co. before summer. Aliphatic hydrocarbons will be turned into aromatics. McCarthy will get ethylene from ethane by dehydrogenation using a new catalyst. Formaldehyde will be among the secondary products.

•

Few sulphite pulping mills are built any more. Most new mills are sulphate, or kraft, mills. A few use the newer magnesium oxide process. In these mills magnesium bisulphite is the ultimate active principle. Weyerhaeuser's West Coast mill will be running on the magnesium oxide process by March. These newer mills are "closed," in the sense that little effluent comes from them to pollute streams. Chemicals are recovered. Some wastes are burned as fuel.

•

Amine salt of 2,4-D is Du Pont's newest weed killer. It can be used as a liquid in either dilute or concentrated sprays.

•

New manual for management tells how to cut down stream pollution. A committee of the Manufacturing Chemists' Association authored the manual. It shows how chemical plants can control effluent and recover valuable byproducts.

How to keep from polluting streams has always been a problem in the process industries. Officials of local, state and federal governments watch carefully what industry dumps into streams. But legislation will not prevent pollution. Engineering will.

Now MCA takes the lead in showing how to solve this problem. Chemical management should put this manual in the hands of its engineers.

•

Wrought Durimet 20 in rods, bars, wire, strip and welded tubing is available at last. Durimet 20 is hard to roll because of its high alloy content. But Carpenter Steel Co., under licenses on Duriron patents, now rolls the popular alloy in its Reading, Pa., mill. Carpenter deserves a feather in its cap. Wrought products will be marketed under the name Carpenter Stainless No. 20.

•

Ammonia process for pulping wood is now used at Sheldon, Wash., by Rayonier. Eastern Corp. at Bangor, Me., is experimenting with it. Other companies are also trying the process. Lower ash content of the pulp made by the ammonia process is a big boon to rayon makers. But recovery of chemicals in these mills is still a big problem.

•

Monsanto will get $25 million in credit from a group of bankers over a three-year period.

•

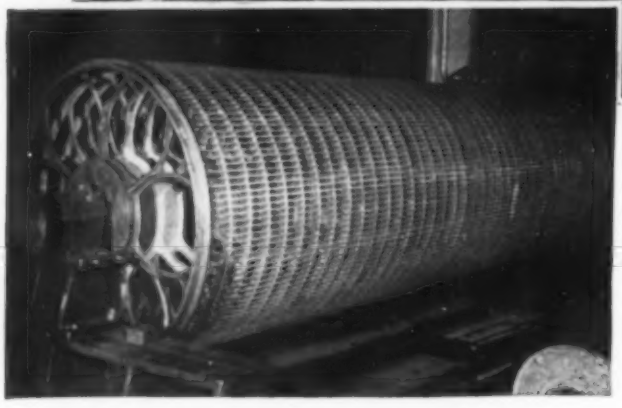
Stockholders of Du Pont numbered 97,135 at the end of 1947, an increase of 5,341 since December 31, 1946.

•

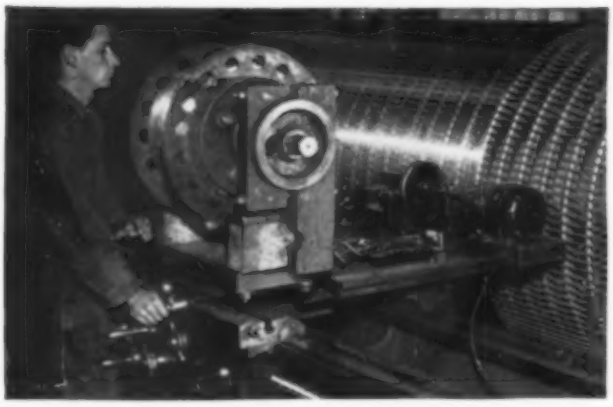
War Assets Administrator Jess Larson moves in strange ways his plants to dispose of. He recently set aside three bids on a plant at Salt Lake City, Utah. During the war Kalunite, Inc., made alumina there experimentally. But all three bidders planned to convert the plant to fertilizer production. Highest of the rejected bids was the $752,000 offer of American Potash & Chemical Corp. Next was the $635,000 bid of Columbia Metals Corp. Lowest

Anaconda*

EVERDUR—Cylinder molds for the multi-cylinder paper board machine, shown here in process of erection, are completely fabricated from Everdur by the Bagley and Sewall Company of Watertown, New York.



Spider frames for cylinder molds are cast of Everdur and tied together with ⅜" Everdur Rods—notched for winding with Everdur wire.



Miles of ⅛" Everdur wire being wound on spider frames to complete cylinder mold. Engineered to last—these Everdur molds combine high strength with excellent resistance to corrosion.

MANY PROBLEMS in the fabrication of chemical and processing equipment are readily solved through the use of one or more of the many Anaconda Metals—copper and copper alloys.

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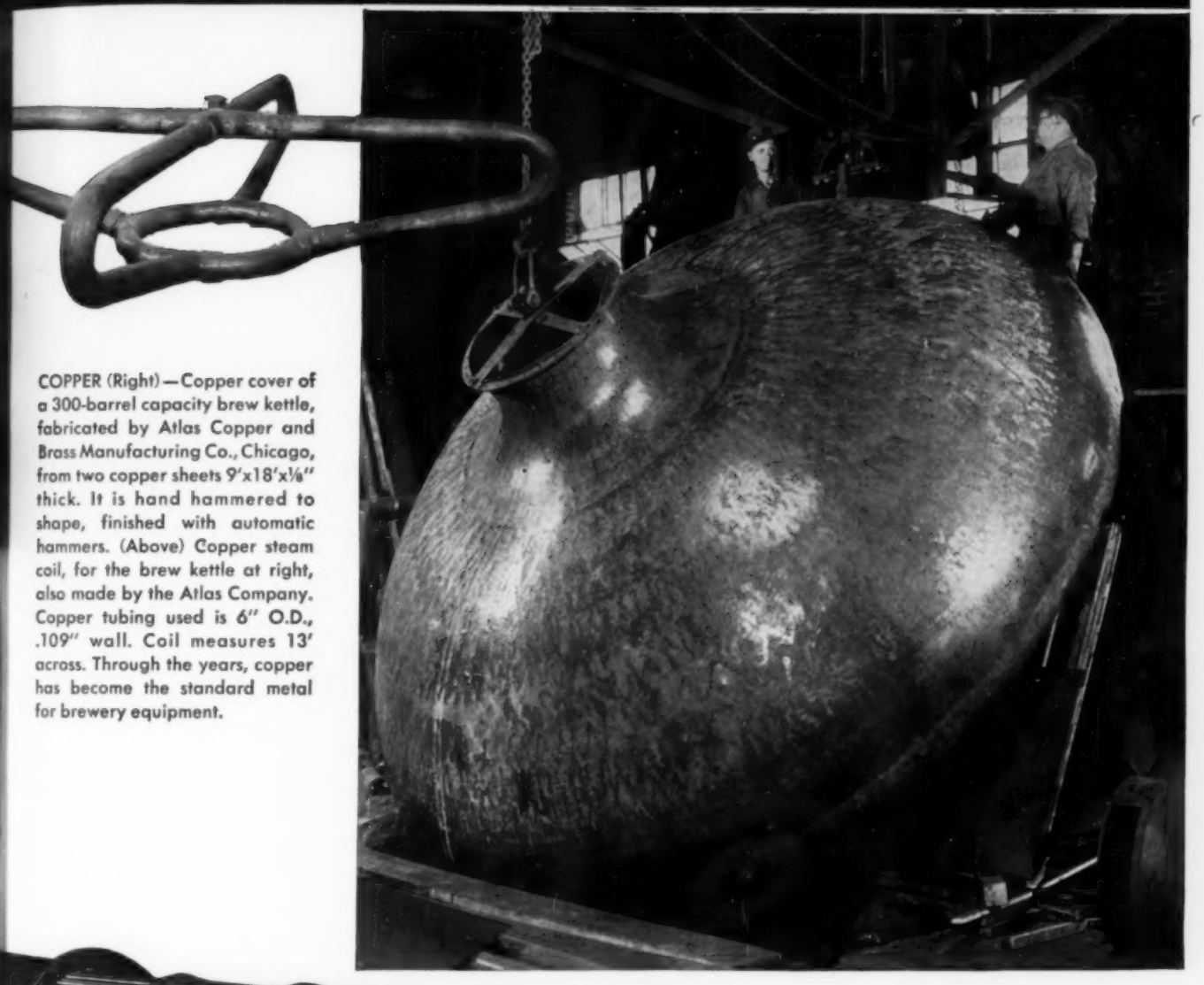
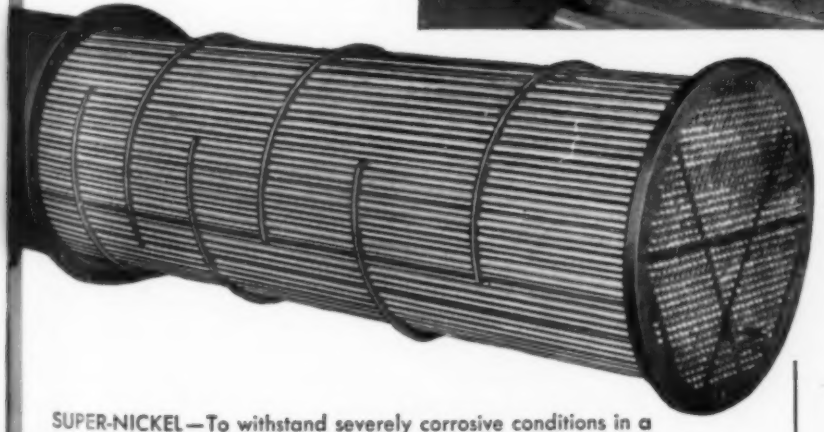


COPPER (Right)—Copper cover of a 300-barrel capacity brew kettle, fabricated by Atlas Copper and Brass Manufacturing Co., Chicago, from two copper sheets 9'x18'x⅛" thick. It is hand hammered to shape, finished with automatic hammers. (Above) Copper steam coil, for the brew kettle at right, also made by the Atlas Company. Copper tubing used is 6" O.D., .109" wall. Coil measures 13' across. Through the years, copper has become the standard metal for brewery equipment.



SUPER-NICKEL—To withstand severely corrosive conditions in a Gulf Coast plant processing natural gas, three heat exchangers like the one shown here were fitted with Super-Nickel tubes. These units, built by Downington Iron Works, Inc., Downington, Pa., condense water vapor from a mixture of carbon dioxide and steam, using brackish river water as the coolant. Bundles contain 940 tubes each, ¾" O.D. x .083" wall x 16' long.

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bid was $625,000, offered by J. R. Simplot Co. But Larson's next move was even more amazing.

Larson wants small business to compete with big corporations in the fertilizer industry. In his opinion, Simplot qualifies as a small business. So he offered the Salt Lake City plant to Simplot, the lowest bidder, at the highest bid price, American Potash's $752,000 figure. Larson ignored American Potash, originally the highest bidder, because it happens to be a big corporation.

Another of these experimental alumina plants at Salem, Ore., is up for sale. Fertilizer can also be made there. In his plans to dispose of this plant, Larson has gone even further. No bids will be sought. Instead, Larson has decided to negotiate directly with the present operator, Columbia Metals Corp., another small business, for sale of the property.

Larson seems to have adopted his own interpretation of the Surplus Property Act. Perhaps the Act needs clearing up. But sale to the highest bidder is still sound business ethics.

•

Following the lead of Du Pont and American Viscose, Celanese has boosted its prices on cellulose acetate and viscose filament yarn. Increase ranges from 10c. a lb. on 45-denier to 5c. a lb. on 450-denier. On 150-denier, 40-filament yarn, the rise is 7c. Staple prices are unchanged.

•

Caustic and chlorine continue short. Adding capacity chews up capital. It is now estimated that it takes $80,000 to add a ton a day to chlorine capacity. In 1946 it cost about $60,000, and before the war only $40,000. Power is still the biggest single item in production costs.

•

Chemical Corps will sell Huntsville Arsenal. Pared budget forced the sale. No one ever expected the Chemical Corps to move its headquarters from Edgewood Arsenal, Md., to the Huntsville, Ala., site. Such a move would have cost $50 million that Congress would not give.

Big chemical companies have an eye on Huntsville. But they want titles to parts of the property or long-term leases. Any new leases would be subject to those previously made. Solvay has a five-year lease on chlorine-caustic facilities. Other small units are leased by their operators, including one auto manufacturer.

While chemical munitions will no longer be made there, the Army wants Huntsville back and ready to go again on munitions in a hurry should a military emergency come. Such a clause will be written into any contracts that are signed.

WAA started unraveling the red tape in January and should be ready to talk terms with would-be buyers and renters this month. But it will take a long time to dispose of Huntsville.

•

If Congress let Rubber Reserve cut plant retirement charges to 1c. a lb., government rubber could sell at 15½ to 16c. a lb. There is little hope that private industry could equal or better such a price. If private industry made GR-S, profits on major raw materials and the rubber itself would have to be added. Costs in private plants would be at least 1c. a lb. higher.

•

Canada has plans afoot to cut or even stop exports of pulpwood. Such a move would hit United States pulp and paper industry hard. American mills depend on Canadian pulp.

•

Sound waves are going to work in process industries. Ultrasonic Corp. of Cambridge, Mass., has erected a unit to precipitate carbon black for Godfrey L. Cabot, Inc., at Pampa, Tex. Sound vibrations force the carbon particles together. Clumped particles fall into a collection bin at the flue bottom. Carbon is saved, and no soot falls on the countryside. The sound is produced by a siren that can convert as much as 50 percent of the energy available in compressed air into sound. The sonic apparatus is cheaper and perhaps as efficient as a dry electrostatic precipitator. A Maine paper mill uses a similar installation to prevent soda ash from polluting surrounding air. Other fields where the method appears promising are in precipitation of acid mists and tar fogs. Conventional dust and fume collectors may be in for competition.

Emulsions can be made by sound vibrations. Crystal Research Laboratories of Hartford, Conn., is exploring this field. Already some manufacturers of drugs, cosmetics and fountain sirups have put sound to work making emulsions. Half a dozen dairies use sound to kill bacteria and break down the fat globules in milk. Treated milk keeps longer and is more digestible than untreated milk.

Sonic and ultrasonic vibrations have other uses. The Navy is experimenting with sonic precipitation of fog over airfields. A device known as a Reflectoscope detects flaws in materials. Sound waves emitted by a quartz crystal travel through the material and are reflected. Their echo produces oscillations on the screen of the Reflectoscope. Such an instru-

As the white outline indicates, a standard unit of much greater frame size would be required to do the work of Speedaire.

$2176 saved on SPEEDAIRE alone

ON four Stock Chest Agitator drives in a cigarette paper plant, a company installed four Speedaires. The units are installed in pairs, one above another, and the top unit shuts off automatically when paper stock is withdrawn to a certain level.

On the speed reducers alone the company saved $2176, compared to the cost of conventional worm gear units. Still further saving was made in erection expense, because the smaller size and lesser weight of Speedaire permitted a reduction in the length of the platforms supporting the drives.

Speedaire is Cleveland's new fan-cooled worm-gear speed reducer. Because it is fan-cooled, Speedaire will do more work—will deliver up to *double the horsepower* of standard worm units of equal frame size, at usual motor speeds. It can be installed economically on many applications where other types have been used heretofore—giving you the advantages of a compact right-angle drive. Speedaire gives the same long, trouble-free service characteristic of all Clevelands.

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Speed Reducers

ment can also measure thickness. Erie Railroad now checks locomotive axles after every 15,000 miles for fatigue cracks by this method. Dr. R. H. Wallace of the University of Connecticut believes he has increased yield of hybrid corn by 15 percent with sound-treated seeds.

•

Man's fight against fire goes on. New paneling for airplane firewalls protects human flesh within one inch of fire at 2,200 deg. F. The light-weight, fire-resistant panels are constructed of specially treated Du Pont cellular cellulose acetate plastic sandwiched between sheets of 0.006-in. carbon steel. Skydyne Corp. makes the new Pyroply paneling. Many airlines have adopted Monsanto's Skylac, fire-retardant fabric finish for aircraft, which more than meets CAA requirements. Test panels sprayed with Skylac were saturated with gasoline and fuel oil. Ignited, they charred slightly and snuffed out.

Monsanto's ammonium phosphates fight fire too. Albi-"R," a fire-retardant paint, contains them. When fire strikes, Monsanto's ammonium phosphates release ammonia gas, cutting off oxygen. Meanwhile a tough phosphate film protects and insulates the surface. Lumber is also safeguarded against fire by impregnating it with a mixture of ammonium phosphates and a wetting agent. The mixture, Monsanto's Fire Retardant A, is injected into the lumber by a vacuum-pressure method that insures desired retention.

Penetrating action of the new Carbide & Carbon wetting agent Unox adds the dimension of depth to fire fighting. "Wet water," containing as little as 1 gal. of Unox in 100 gal. of water, soaks quickly down into burning material, extinguishing deep fires. It works best on building fires, fires in bales of cotton or paper, fires in mattresses and upholstery, and grass, brush and forest fires. "Wet water" puts out fires two to four times as fast as ordinary water. Less water is needed, cutting water damage. There is less smoke.

Ordinary wetting agents cause water to rust metal. But Unox contains a corrosion inhibitor. The "wet water" solution does not stain or injure textiles, wood or other materials. The penetrant does not separate or evaporate from the solution. It is not affected by reasonable temperature changes. It is effective in hard, soft or salt water.

•

Higher alcohols have a future as resin plasticizers. In a few months Standard Oil Development Co. will make higher alcohols in a large pilot plant at Baton Rouge, La. Carbon monoxide and hydrogen produced by the synthesis process will be combined at 3,000 psi. with olefins from the refinery. Of chief interest at the outset will be the octyl isomers. But the pilot plant where this work will be done has quite a history.

Once this pilot plant was used for the catalytic hydrogenation of gas oils. Dating from the early Thirties, this pilot plant, with its heavy concrete barricades, was often called Fort Haslam-Russell after the two Bobs. Now it will be converted to higher alcohol production.

•

A new synthetic rubber may equal or surpass natural rubber in tire treads. Two plants are being equipped to make it. U.S. Rubber runs the one at Borger, Tex., while Copolymer Corp. operates the other at Baton Rouge, La. Road tests of tires are slated for this year and next.

If the new GR-S excels natural rubber in tires, it will have a market even at a fancy price. About 30 percent of natural rubber used goes into tires. Success of this new GR-S will go a long way toward making the synthetic rubber industry self-sustaining.

Low-temperature polymerization led to this improved rubber. Butadiene and styrene now react between zero and 40 deg. F. instead of at 125 deg. F. Synthetic rubber industry, sponsored by Rubber Reserve, did the research.

•

Transfer of synthetic rubber plants from government to private hands should be delayed another year. Meanwhile, enough natural rubber, perhaps 800,000 tons, can be stockpiled to insure national security. By March 1949 the stockpile should be big enough. Then, thinks U.S. Rubber's president Herbert S. Smith, the government can sell the synthetic plants and end mandatory use of synthetic.

•

Synthetic rubber research, says E. U. Condon, who heads the National Bureau of Standards, should get $4 million a year of government money. That is less than 1 percent of what this country pays for 1 million tons of rubber it annually consumes. Industry should put up another $4 million to develop new synthetic rubbers, in addition to what it spends for end-product research.

Cost of such a research program is small compared to the value of the commodity and its importance to national security. To keep synthetic rubber plants in standby condition costs over $8 million a year. If another emergency comes, these plants will be obsolete. A federal expenditure of half this sum on research, to insure our future in this field, is far more practical.

CHEMICAL ENGINEERING

with CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902 FEBRUARY 1948 SIDNEY D. KIRKPATRICK, Editor

Where Have We Been . . .

and Where Are We Going?

Janus am I; Oldest of the potentates!
Forward I look and backward and below
I count — as god of avenues and gates —
The years that through my portals come and go.
— Longfellow

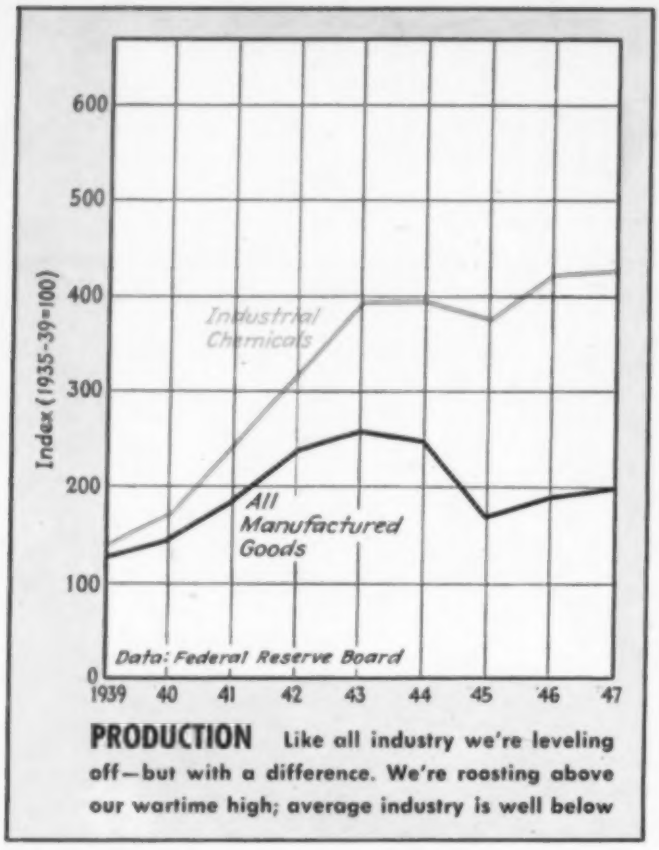
DOWN through the ages, Janus, the double-faced deity of Roman mythology, has stood as a symbol of stock-taking. Because he could look simultaneously on both the past and the future, he has always had certain advantages over ordinary mortals—including the editors and contributors who have collaborated in preparing this twenty-fifth annual review and forecast issue of *Chemical Engineering*. This is a bit unfortunate, it seems to us, for right now is a particularly appropriate moment for a sober look backward over the road we have been traveling, while at the same time we look forward hopefully to the future.

A year ago we feared a recession but somehow it failed to materialize in 1947. We were then plagued with labor troubles and low productivity. Too much money and too few goods were pushing prices to prohibitive levels. Yet in the face of these disturbing influences, our industries set new records in production and consumption and in provision for new plants and equipment.

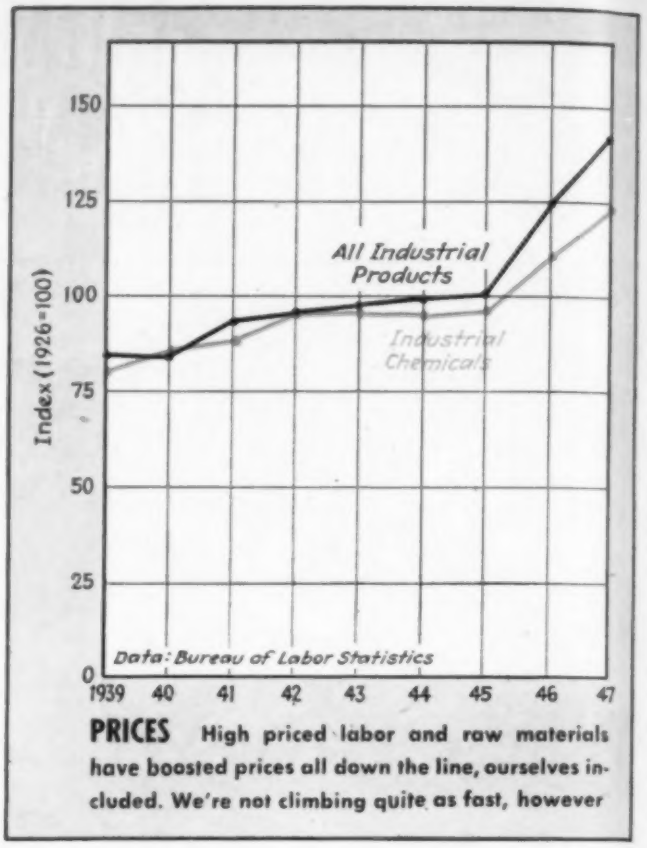
Today we are a year further along in the inflationary boom. Some say we have accumulated sufficient momentum to carry us ahead for at least another twelve months. Others call attention to signposts and warning symbols that we cannot afford to overlook. There is the possibility that money is running out, that some of our programs of capital expenditures can no longer be financed from past earnings. A third round of wage increases would raise costs, push up prices and add to the instability of the present situation. Waste, extravagance, speculation and inefficiency are developing all around us.

So in this crucial year of uncertainties and complexities, each of us is faced with new responsibilities. It is our No. 1 job to avoid the excesses, the mistakes and miscalculations that in the past have always resulted in reaction and sometimes in sudden collapse and severe recession. There is need, not only for the dual vision of a Janus, but also for restraint and cooperation. We need even greater knowledge and understanding of the economic as well as the technical aspects of our daily jobs. For a quarter of a century *Chem. & Met.'s* Annual Reviews have helped provide the facts and figures of our chemical economy. At this critical juncture in world affairs these data take on new and deeper significance.

Sidney D. Kirkpatrick



PRODUCTION Like all industry we're leveling off—but with a difference. We're roosting above our wartime high; average industry is well below



PRICES High priced labor and raw materials have boosted prices all down the line, ourselves included. We're not climbing quite as fast, however

How Are We Doing

Exports, Capital Spending Keep Business Booming, Chemicals Lead

JOHN D. WILSON
DEXTER M. KEEZER
McGraw-Hill Economic Department

CHEMICAL producers set records last year that will be hard to beat in 1948. Record incomes coupled with a huge backlog of needs have encouraged an extraordinary volume of spending by both consumers and business. The result has been intense activity throughout the whole of industry, trade and agriculture. Nowhere is this mirrored more completely than in the chemical industry, which cuts across all these broad fields. And by the same token, nowhere are the promises, problems and uncertainties of the future better illustrated.

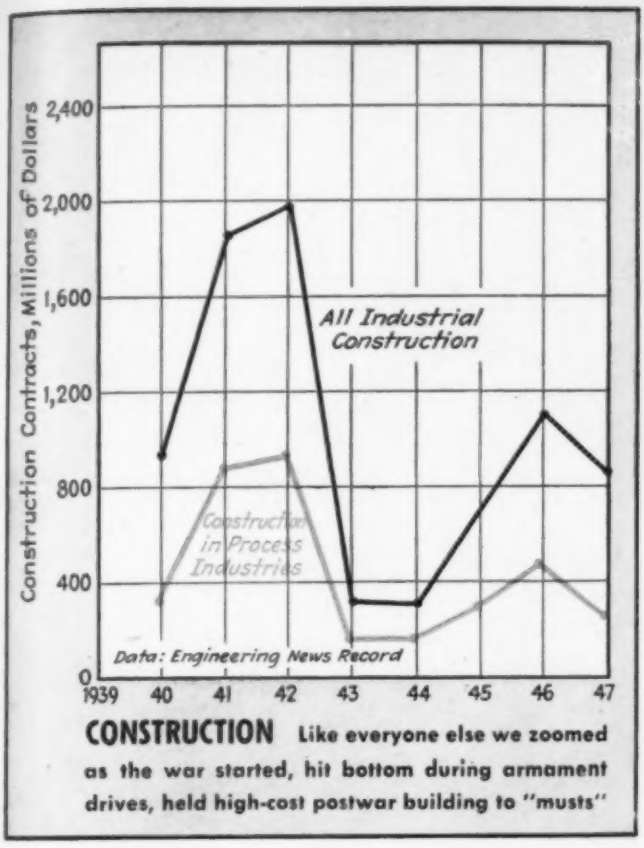
Chemical output in 1947 ran some 7 percent above the wartime record in 1944 and 10 percent higher than 1946. Likewise, industrial production was up about 10 percent and construction activity had increased 28 percent. Moreover, as the year closed business in general clearly was operating at or near peak levels. Unemployment had fallen to 1.6 million, a limit that could hardly be reduced; while steel, oil and other basic materials were in the same tight position as certain of the chemicals.

A look at the distribution of the gross national product (the value of all goods and services produced) gives some idea of the force and character of this boom. Production rate has jumped to an astronomical $242 billion. This is a good $24 billion above the rate of a year earlier. Such a comparison is somewhat misleading, however. For a good part of the gain merely reflects higher prices. As a matter of fact, physical output for the year was up 5 percent, while in dollar terms the rise is about 10 percent. Details for the final quarter of 1947 in contrast to the lineup in 1946 and the war period:

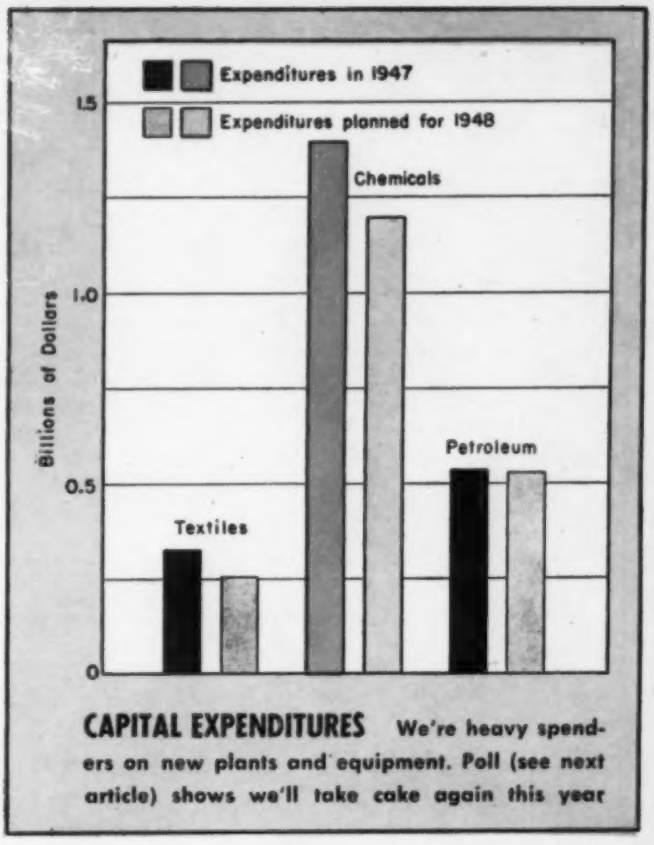
Distribution of the Gross National Product
(Annual Rate, Billions of Dollars)

	2nd Quarter 1945	4th Quarter 1946	4th Quarter 1947
Total gross national product	220	218	242
Consumer expenditures	119	155	172
Nondurables	73	94	104
Durables	8	18	21
Services	38	43	47
Business expenditures	8	30	33
Equipment	6	16	18
Construction	3	9	12
Net change in inventories	−1	5	3
Excess of exports over imports	−3	5	8
Government expenditures	96	28	29

Perhaps the most powerful force behind the current boom has come from two directions: huge capital outlays on the part of business and an



CONSTRUCTION Like everyone else we zoomed as the war started, hit bottom during armament drives, held high-cost postwar building to "musts"



CAPITAL EXPENDITURES We're heavy spenders on new plants and equipment. Poll (see next article) shows we'll take cake again this year

n the Process Industries

emicals to New Production Record. No Fizzle Seen for '48

extremely heavy export demand. Spending from these sources has helped hold employment and consumer incomes at an extremely high level. The impact has been felt not only in the volatile capital goods industries, but also in the demand for such products as textiles, foods and household goods that go directly to the consumer. Indeed, demand for these goods has been so great that producers have been able to get substantially higher prices for them. There is little doubt that consumers will continue to buy heavily in 1948—even at the high prices now prevailing—if weekly paychecks flow regularly. And any general setback in this regard is unlikely so long as business spending and exports carry on as they have.

What, then, is the outlook in these critical areas? The export picture is the more simple. Here the key factor is the European Recovery Program. If adopted, the program will lift exports slightly above the rate of recent months. If not adopted, our foreign shipments will continue the decline that set in at mid-1947. The total might be expected to fall to a rate of $10 billion, in contrast to the $15 or $16 billion rate that is likely once the program gets in full swing.

Capital Goods

On the capital goods side, activity over the near term should hold to its current level. In second-half 1948, however, no one will be surprised if a modest let-down starts to set in. This is likely to be limited to certain equipment lines and in no sense will be general. Capital outlays in the petroleum, electrical utility and farm fields, for example, are expected to top even the high level of 1947. On the other hand, a recent survey by McGraw-Hill (see pp. 102-103) points to an eventual reduction in the capital outlays of most manufacturing industries. The net result, if the McGraw-Hill Survey turns out correct, may be a total volume of equipment expenditures in 1948 that is on the order of $15 billion, a drop of a little more than $1 billion from the 1947 volume.

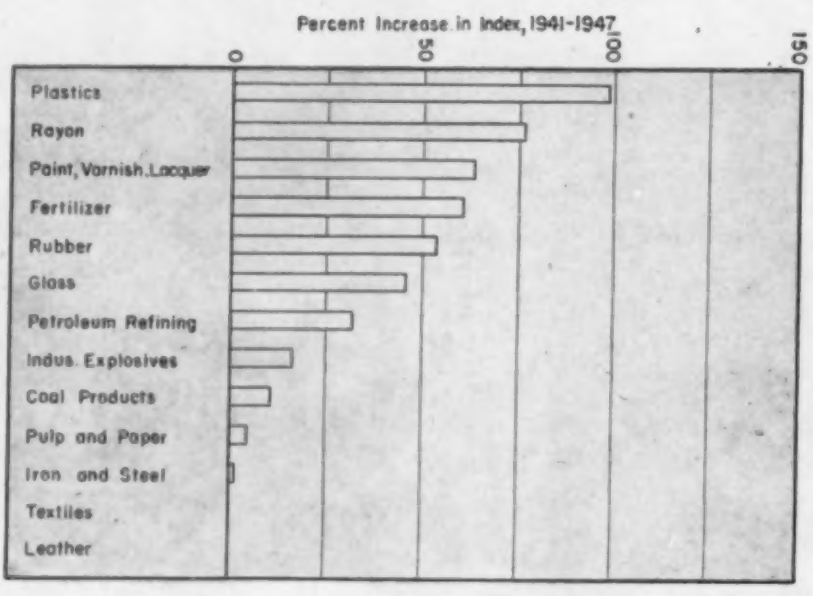
All the above leaves room for only one broad conclusion. Coming months should continue to be good ones for almost all business. But as is always the case, there is an "if" in the picture, the same "if" that was present a year ago. Business will be good, but only if labor and management can work out their differences without serious work stoppages or a round of excessive wage advances. In the event of the latter, prices of capital goods as well as consumer goods will resume their upward march. The danger here lies in the effect another such advance

AMONG OUR CUSTOMERS . . .

	1941	1942	1943	1944	1945	1946	1947
Fertilizers	31.49	37.33	40.12	39.76	42.21	44.70	50.88
Pulp & paper	21.92	20.51	19.05	18.87	19.44	21.70	22.80
Glass	15.03	15.91	18.80	19.93	19.64	21.65	21.83
Petroleum refining	15.20	14.43	15.56	18.10	18.71	18.82	20.02
Paint, varnish, lacquer	15.03	14.35	15.40	16.71	17.37	20.80	24.55
Iron, steel	12.88	13.32	13.49	13.33	11.96	10.20	13.01
Rayon	12.87	14.93	15.53	16.81	18.38	20.02	22.74
Textiles	11.06	11.97	11.43	10.53	10.30	11.25	11.05
Coal products	9.28	9.54	9.47	10.05	9.41	8.15	10.23
Leather	4.88	4.88	4.56	4.25	4.54	4.60	4.83
Industrial explosives	5.54	5.73	5.52	5.06	5.36	6.30	7.44
Rubber	3.91	3.00	3.00	3.00	4.55	6.85	5.98
Plastics	3.71	4.36	4.80	5.24	5.75	6.48	7.37
Total (1935=100)	162.80	170.26	176.73	181.64	187.62	201.62	222.73

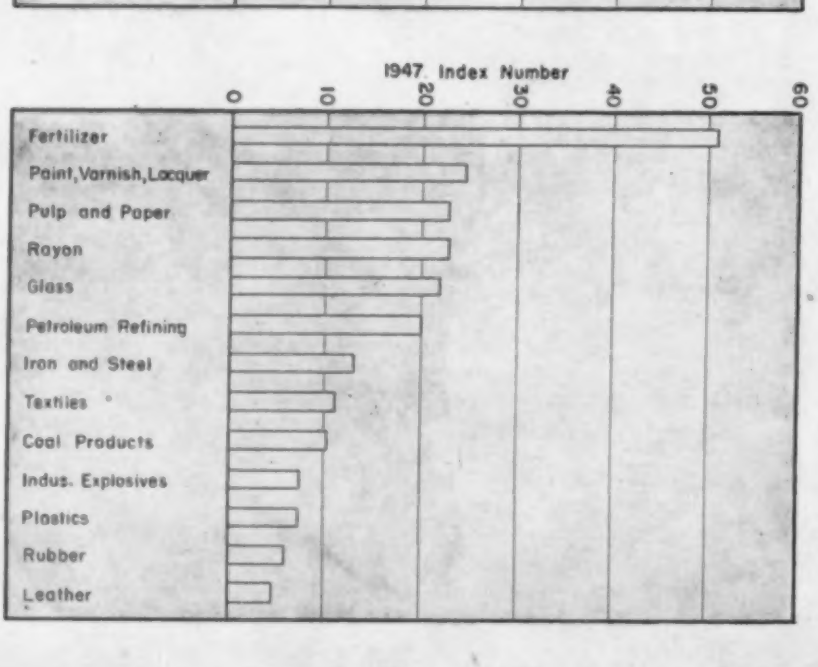
CONSUMPTION INDEX . . .

Chemical Engineering's Index for Industrial Consumption of Chemicals



SHOWS RELATIVE GROWTH . . .

Percentage Increase between 1941 & 1947 in Consumption of Chemicals



AND PRESENT IMPORTANCE

Relative Importance of the Industries As Consumers of Chemicals in 1947

may have on capital spending, and through this, on employment and production in capital goods industries.

The fact that industrial activity probably will continue at a fast clip is the tipoff on the likely situation facing the chemical industry. Nevertheless, this broad conclusion does not rule out the possibility of certain lines facing special problems of demand. Since chemical output itself will be increasing next year, it is well to look in greater detail at the position of the more important industries that consume chemicals. Here they are:

•

Fertilizer—Producers of nitrogen fertilizer are certain to sell all they can produce. The current shortage is world-wide and will continue in spite of new capacity next year. Phosphate supplies are less tight. However, the demand this year will be greater than last, particularly if the European Recovery Program goes through as planned. This same conclusion holds for potash and other fertilizer materials.

In general, farm incomes should be almost as high as the record-breaking total of $30 billion rung up in 1947. Moreover, maintenance of high prices will place a good premium on maximum farm output. Such circumstances are made to order for suppliers.

•

Pulp and Paper—This industry continues to ride an upward trend. Production in 1947 was at capacity, with a gain of 8 percent over the high level of the previous year. In 1948 new facilities for pulp should expand domestic output. This, plus maintenance of heavy imports, will support a rise in paper output. At the paper end, capacity is scheduled to increase some 5 percent. The whole can all be employed if industrial activity holds its present pace.

•

Glass—Here a conservative view of the coming year appears justified. Demand for window glass will move higher with increased construction. Moreover, about 10 percent more automobiles are likely to come off assembly lines. But in the container market—the largest for glass—competition is growing tougher. Production last year was no larger than in 1946 and it is not unlikely that even this rate will not be held.

•

Petroleum—Ability to produce and deliver petroleum products will continue to be the limiting factor in this industry. Current shortages are hardly likely to disappear during this year in spite of the huge expansion now under way. If all goes according to plan, output of petroleum products should advance some 6 percent in 1948. To accomplish this, however, facilities in the producing, refining, transport and distribution ends all need to be expanded.

•

Paint, Varnish and Lacquers—Construction holds the key to this market. On the basis of present evidence new building in 1948 may well be the highest in history. Government estimates place the number of permanent dwelling units that might be completed in 1948 at 985,000, some 150,000 (18 percent) more than in 1947. During 1946 completions totaled only 440,000 units. As suggested above, commercial and utility construction also is expected to increase, but industrial building will be lower.

•

Iron and Steel—This basic industry has fixed an over-all limit for metalworking activity in the United States. Demand for steel is likely to continue at close to capacity even though production of industrial equipment starts to decline slightly in the final months of this year. Steel ingot capacity amounting to about 3 million tons is due to be introduced over the year. This should raise over-all output about 2 percent. Of special interest is the plan of several producers to introduce on a larger scale the new oxygen process for open-hearth furnaces. This yields a larger production through modification of equipment which already exists. Among finished items, sheet and strip have been most scarce. New capacity has lagged, but the 3 million tons scheduled for introduction between mid-1947 and the end of 1948 should all be at work next year.

•

Textiles and Rayon—Cotton textile output on a poundage basis was down some 4 percent in 1947. Activity currently stands midway between the high of 1946 and the subsequent low. The postwar peak is not likely to be regained. As a matter of fact, chances now seem to favor a volume this year about equal to 1947.

The let-down in woolens in 1947 was even more sharp—about 20 percent. Here again production has made somewhat of a comeback. It may hold to the current level but at present prices is hardly likely to move higher for any sustained period.

Rayon output, as usual, is the exception when textile declines are in order. The strong growth trend for rayon products has by no means worked itself out. Capacity is still undergoing expansion and more production gains are anticipated this year. However, something less than the 13 percent increase in 1947 appears to be in the offing.

•

Coal Products—Output here is keyed to coke production, particularly that which supports activity in iron and steel. Since iron and steel production is expected to be slightly greater in 1948 with completion of new facilities, production of such byproducts as sulphate of ammonia and toluol will also move up by small amounts.

•

Leather—Consumption of leather in 1947 was changed little from 1946. The outlook for this year is uncertain. High prices are making themselves felt in the shoe market. Consumer resistance plus a likely decline in domestic hides supplies may cut demand and production of these and other leather products. Any reduction, however, is not likely to be great.

•

Rubber—Rubber production fell off from the high level reached in late 1946. The reason was a simple one. The extraordinary peak demand achieved in the course of 1946 and early 1947 was based in part on the replacement of depleted inventory. Consumers and dealers in tires and other rubber products were able to fill most of their war-accumulated deficiency by the spring of 1947. Since then demand has continued to be extremely heavy, but on a more normal basis. In 1948 rubber consumption is expected to average somewhat less than in 1947 as the first quarter falls below the high level of a year earlier. Moreover, the chemical industry will feel still another development. During the year the proportion of natural crude rubber will be further increased.

•

Industrial Explosives—Consumption of industrial explosives has been running at an extremely high rate. This appears almost certain to continue, barring a serious work-stoppage in mining. Heavy construction in 1948 should be greater than a year ago; this alone could bring a further modest advance in their use.

•

Plastics—This is another industrial group with an upward growth trend. Consumption in 1947 was somewhat higher than in 1946, partly because an improved flow of raw materials made possible a heavier utilization of existing capacity. Even in the face of this general movement, however, a few soft spots appeared—thermo-plastics being an outstanding case in point. In 1948 plastic output as a whole should be further increased. New capacity in both raw material and finishing ends will make such a gain possible.

How Much for New Plants an

QUESTIONS . . . . . AND ANSWERS

How deep will industry dig? McGraw-Hill survey finds the facts

		All Mfg.	Food	Textiles	Chemicals	Petroleum	Metal Prod.	Metal Work.	Elc tr. Mach.	Automobiles	Misc.
Do you expect sales of your company in 1948 to be higher or lower than in 1947?	Higher	57%	56%	62%	72%	79%	37%	49%	68%	68%	57%
	Lower	9	12	4	7	1	14	7	4	1	9
	Same	34	32	34	21	20	49	44	28	31	34
If higher, by how much?	Median	20	15	20	15	10	25	15	20	30	20
What proportion of your postwar expansion program is now complete?	100%	30	24	20	25	11	31	44	46	6	33
	60-99%	30	22	39	34	16	31	27	31	65	21
	Under 60%	40	54	41	41	73	38	29	23	29	46
How much of it will be complete by the end of 1948?	All	66	59	50	65	26	65	75	78	84	65
	60-99%	17	15	25	17	54	14	15	5	13	16
	Under 60%	17	26	25	18	20	21	10	17	3	19
When your postwar expansion is complete, how much greater will your capacity be than it was in 1939?	100+ %	31	28	32	32	27	24	36	36	43	23
	50-99%	17	18	10	21	16	15	15	13	13	19
	5-49%	29	31	34	28	37	35	30	39	28	23
	No greater	23	23	24	19	20	26	19	12	16	35
How much did you spend for new plant and equipment in 1947?	$ Millions	$7525	$730	$325	$1400	$540	$900	$1190	$480	$780	$1180
How much planned for 1948?	$ Millions	$6056	$480	$256	$1200	$535	$790	$ 550	$195	$600	$1450
How much of your planned capital expenditures have been placed under contract?	All	26	32	32	17	11	18	14	27	—	46
	60-99%	8	9	10	12	8	17	6	11	3	6
	1-59%	36	34	16	42	47	33	36	43	90	26
	None	30	25	42	29	34	32	44	19	7	22
How much will be under contract by June 30?	All	57	64	73	47	36	54	47	39	44	73
	60-99%	20	18	13	13	33	20	27	37	20	13
	1-59%	17	11	9	25	19	15	20	24	35	9
	None	6	7	5	5	12	11	6	—	1	5
If wage rates go up 15-20%, will you increase or decrease your capital budget substantially?	Increase	26	17	25	30	14	48	14	23	45	26
	Decrease	17	30	13	7	7	2	32	12	15	16
	No change	57	53	62	63	79	50	54	65	40	58
Would you cut your capital budget if business activity declined 20%?	Yes	18	14	7	31	23	11	23	16	34	12
	No	41	47	62	38	63	40	37	41	25	37
	None planned	41	39	31	31	14	49	40	43	41	51
How will you finance 1948 capital budget? What proportion by:											
New issues of stocks or bonds?	None	94	84	94	94	72	100	89	98	100	98
	All	2	0	4	0	6	0	6	0	0	0
Commercial Bank Loans?	None	79	69	85	68	80	84	90	85	91	74
	Half	7	14	9	7	8	3	2	10	2	10
	All	4	4	0	8	1	8	1	2	2	4
Profits, Reserves & Surplus?	None	6	7	4	8	6	7	7	2	2	4
	50-99%	15	22	11	25	30	12	8	11	3	17
	All	74	62	81	59	58	78	80	85	91	73
Do you think you will spend more or less for new plant and equipment in 1949 than in 1948?	More	17	18	19	22	25	14	12	16	22	14
	Less	28	28	30	28	26	22	36	20	16	29
	Same	19	15	21	14	14	26	18	26	13	22
	No Plans	36	39	30	36	35	38	34	38	49	35

...quipment?

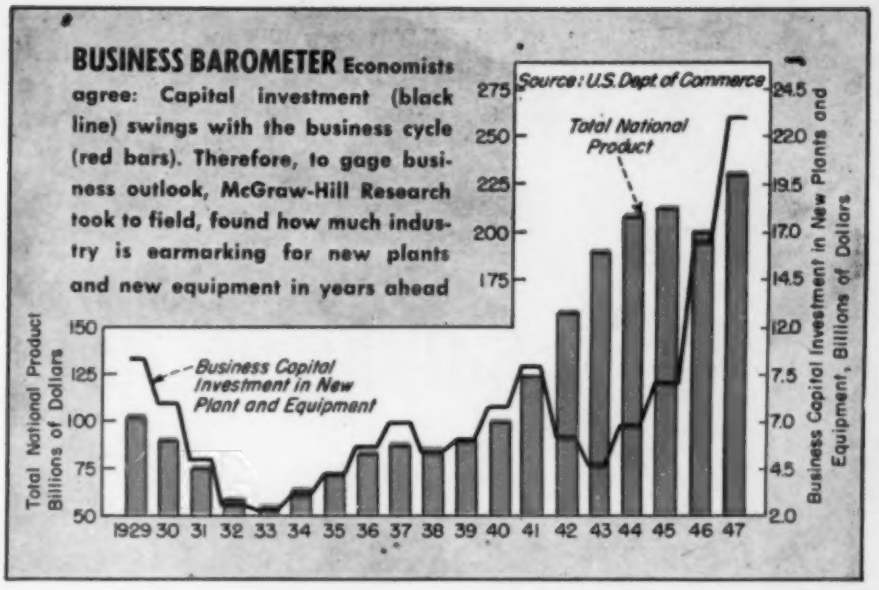
...l Points to $6 Billion

...is Year, Much Less Next;

...shot: Business Good in '48,

...uble in '49; Looks Bet-

...for Us Than Most Mfg.


Source: U.S. Dept of Commerce
Total National Product
Business Capital Investment in New Plant and Equipment
Total National Product Billions of Dollars
Business Capital Investment in New Plants and Equipment, Billions of Dollars
1929 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47

BUSINESS BAROMETER Economists agree: Capital investment (black line) swings with the business cycle (red bars). Therefore, to gage business outlook, McGraw-Hill Research took to field, found how much industry is earmarking for new plants and new equipment in years ahead

THE YEAR 1948 will see the boom run on, but 1949 promises trouble. That is the major conclusion of an exhaustive McGraw-Hill survey of business plans conducted by its Departments of Economics and Field Research. In making this survey, McGraw-Hill researchers all over the nation personally interviewed top executives of companies carefully selected to make a scientific cross-section of industry. Each executive was asked to give, not his *opinion* about general business trends, but *factual details* about his company's plans for 1948. By adding together the plans of the companies interviewed, McGraw-Hill has secured, for the first time, a reliable picture of what business plans to do in the months ahead.

Greatest contribution of this survey is the information as it applies to business plans for the purchase of new plants and equipment. What business plans to do about such expenditures was by far the biggest unknown in the 1948 outlook. For if business plans to slash them to the bone because its postwar expansion was completed, or for other reasons, that fact alone could bring a sharp downturn in business.

However, this survey shows that the postwar expansion program has more than a year to run. So, at most, business purchases of new plants and equipment this year will decline moderately from last year's record figure. Combined with what was already known about the 1948 outlook for other sectors of the economy, this means that the boom will run on through most or all of 1948.

On the other hand, the survey comes up with two findings that promise some severe economic headaches in 1949. Business capital expenditures will make a nose dive unless something is done soon to reinforce the incentive to maintain such expenditures. About the same time, industry's vastly augmented productive capacity will pour forth a huge flood of most of the products that are hard to buy now. The combination of a slash in business capital investment and a large increase in finished goods production is the stuff out of which business slumps have been made in the past. To prevent that combination from producing a painful setback in 1949 may turn out to be our No. 1 economic problem.

Capital Investment

Chemical engineers are vitally concerned with capital investments in the chemical, petroleum and other process industries. "Chemicals" for the purpose of this survey refer to the U. S. Census group of industries producing chemicals and allied products. Here are the chief conclusions for these industries:

1. Sales in 1948 will be higher than 1947's say 72 percent of the executives in chemicals and 79 percent in petroleum as compared to 57 percent of the total sample in all manufacturing. But with production limitations in mind, chemical and petroleum executives see relatively smaller increases. On the average, business men see chemical sales up 15 percent, petroleum 10 and all manufacturing 20 percent.

2. Postwar expansion continues at a high rate. Chemical companies, on the average, have "completed"* 55 percent of their programs, petroleum companies only 43 percent and all manufacturing 64 percent. Although the chemical industry has a smaller proportion complete now, by the end of 1948 it expects to have finished 85 percent of its planned postwar expansion, about the same proportion as for all manufacturing. Petroleum companies, with a still smaller proportion complete expect to have finished 75 percent by the end of 1948.

3. Capital expenditures will decline somewhat in 1948—as was expected. In the over-all business economy, they may be down 10 percent from last year's 16 billion—but that is not enough to make more than a dent in the boom. Chemical companies report plans to spend $1,200 million in 1948 against $1,400 million spent in 1947. Petroleum companies plan to spend $535 million compared to $540 last year. However, 31 percent of the chemical companies and 14 percent of the petroleum industry have not yet decided what their capital budgets will be. Most of these are smaller companies but their plans will undoubtedly make up for part of the drop.

4. Neither third-round wage increases nor slumps will affect capital expenditures substantially. If wages increase 15 to 20 percent this year, 30 percent of the chemical and 14 percent of the petroleum companies would actually increase their budgets. Only 7 percent in each group would cut them. Others would not change their

(*Continued on page 109*)

* In one sense no chemical plant expansion or modernization program is ever completed. Therefore, the replies must refer to the termination of specific construction projects already definitely planned or authorized.

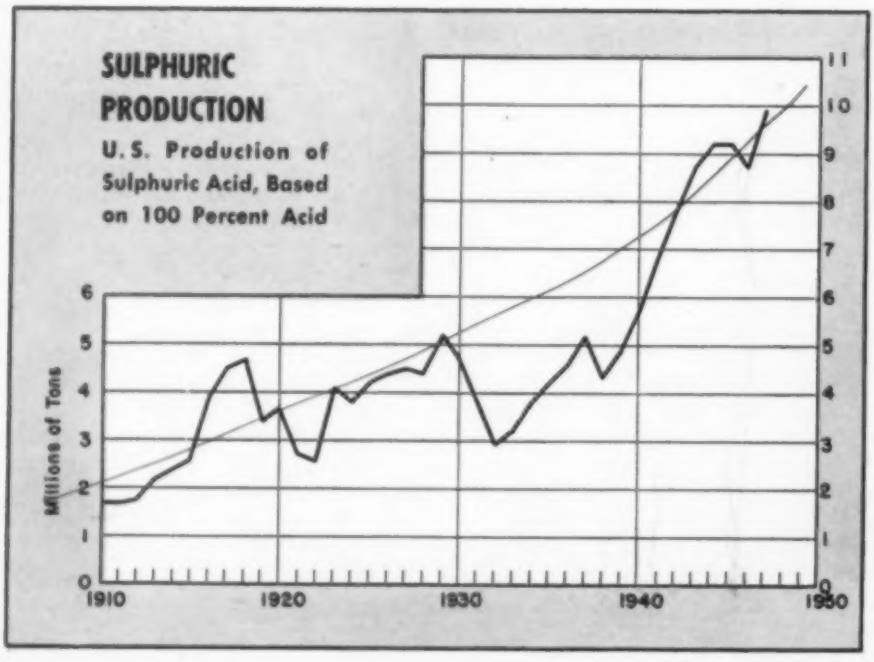
Sulphur and Sulphuric Acid

Acid Has Best Year Yet, Crowds 10 Million Tons; Industry Tries New Methods, Splurges on Construction

BALANCE SHEET U.S. Sulphur Activity and Sulphuric Acid Production; Sulphur and Pyrites in Long Tons; Acid in Short Tons, 100 Percent

	1945 (Revised)	1946 (Revised)	1947[1]
Sulphur mined	3,753,188	3,859,642	4,450,000
Sulphur exports	918,691	1,189,072	1,310,000
Domestic shipments[2]	2,931,000[2]	2,905,119	3,390,000
Approximate mine stocks, Dec. 31	3,500,000	3,200,000	2,950,000
Sulphur imports plus sulphur from fuel gases	12,000	35,000	30,000
Users' stock changes	−50,000	40,000	45,000
Non-acid uses of sulphur	780,000	830,000	910,000
Sulphur available for acid	2,213,000	2,070,000	2,465,000
Acid from sulphur	7,080,000	6,628,000	7,890,000
Pyrites imports	186,507	182,893	140,000
Domestic pyrites	722,596	813,372	840,000
Acid from pyrites	1,155,000	1,254,000	1,230,000
Acid from smelters	843,000	707,000	730,000
Acid from hydrogen sulphide	60,000	60,000	60,000
Total sulphuric acid made	9,137,000	8,649,000	9,910,000

[1]Estimated from 10 months figures. [2]Includes deliveries from distributing points to agree with Bureau of Mines reporting method of employing "apparent sales;" also includes changes in consignment stocks.



JUST AS chemicals in general enjoyed the largest year on record in 1947, sulphuric acid surpassed its earlier peaks with an estimated total of 9,903,000 short tons (100 percent basis). Exceeding the previous 1945 high by 8 percent, and bettering 1946 by 14.5 percent, this enormous total confounded the pessimists who could not see how the war-born capacity could ever be utilized fully again.

Equally as surprising as the increase in production was the large amount of new sulphuric acid plant construction completed in 1946 and 1947, or still to be completed this year. Ten new plants went into production during 1947. From the end of the war until the present, new acid capacity added amounts to about 4,800 tons per day (1,700,000 tons annually), most of which is already in production. One estimate places our rated annual capacity at 12,000,000 tons by spring 1948. The answer to what appears to be excess capacity lies, it is believed, in the relatively short distances acid can be shipped and in the fact that not all capacity is at the optimum locations.

There has, for example, been a large increase in the number of superphosphate plants in the last few years, with approximately 100 new plants going into service, mainly in the South and West, since 1940. Several more will be ready to run this year.

Other large using industries are also developing or expanding at locations where acid supplies have been inadequate. Synthetic chemicals in wide variety, and a large but still insufficient expansion in TiO_2 are examples.

The record in sulphuric acid brought with it another record, that of the domestic sulphur industry. Over 18 percent more sulphur was mined in 1947 than in any previous year. The estimated 4,450,000 long tons produced was still not sufficient to take care of both the domestic and export

needs, and stocks at mines declined to about 2,950,000 long tons, the lowest in many years. With exports placed at about 1,310,000 tons and domestic shipments at about 3,390,000 tons, this means that total shipments—estimated at 4,700,000 tons—exceeded the previous peak in 1946 by 15 percent.

This high rate of sulphur usage brings up a question of future policy in regard to sulphur exports and the development of supplemental sources. In 1947, allowing for some stock-piling in users' hands, the disappearance of American sulphur amounted to over 4,650,000 long tons out of an unknown total reserve which one authority has suggested may not be more than 60,000,000 tons. Offset against this was the use of not more than about 665,000 tons of sulphur equivalent, or less than 15 percent, in supplemental materials including domestic and imported pyrites, smelter fumes and H_2S. Further expansion in both acid making and elemental sulphur recovery from H_2S is already under way, but these are still minor in comparison with what appears to be the projected demand. Fortunately both pyrites and smelter fumes are relatively unlimited, while the possibilities for further recovery of sulphur from coal and from petroleum gases are far from exhausted. Eventually we may even find it economic, as in Europe, to use gypsum as a sulphur source.

During 1947, then, it is estimated that 28 percent of the sulphur shipped went into exports, 19.5 percent to domestic non-acid uses, and 52.5 percent into domestic sulphuric acid. Of the acid produced, on the other hand, 78 percent came from sulphur, 12.2 percent from pyrites, 7.2 percent from smelter fumes, and 0.6 percent from H_2S. Although most of the difference has been made up by increased domestic pyrites production, pyrites imports stand at only a fraction of the prewar level and at present come largely from Canada. We estimate, for example, that imports were only 140,000 long tons in 1947, whereas they amounted to 407,000 tons in 1940 and were generally in the range from 300,000 to 500,000 tons in the previous decade. Domestic pyrites, usually a little less in tonnage than the imported from 1920 to 1933, has since that year exceeded the imported tonnage and increased at a relatively uniform rate to an estimated 840,000 tons in 1947.

Acid Consumption

Sulphuric acid consumption in 1947 is believed to have been close to production, about 8 percent over the previous record year of 1945, and nearly 15 percent above 1946. Except for a small loss in textiles, every major consuming branch contributed materially to the increase. Fertilizers, already mentioned, took about 16 percent more than in 1946 and chemicals nearly 12 percent. The increase was over 23 percent for ammonium sulphate at coke ovens, 20 percent for titanium pigments, 16 percent in steel pickling, 12 percent for other metallurgical operations, and about 10 percent for rayon and industrial explosives. One of the largest uses, petroleum refining, required more than a 6 percent increase. An important and increasing acid use that should be watched is in the soapless detergents, most of which are sulphonated products, now largely derived from petroleum.

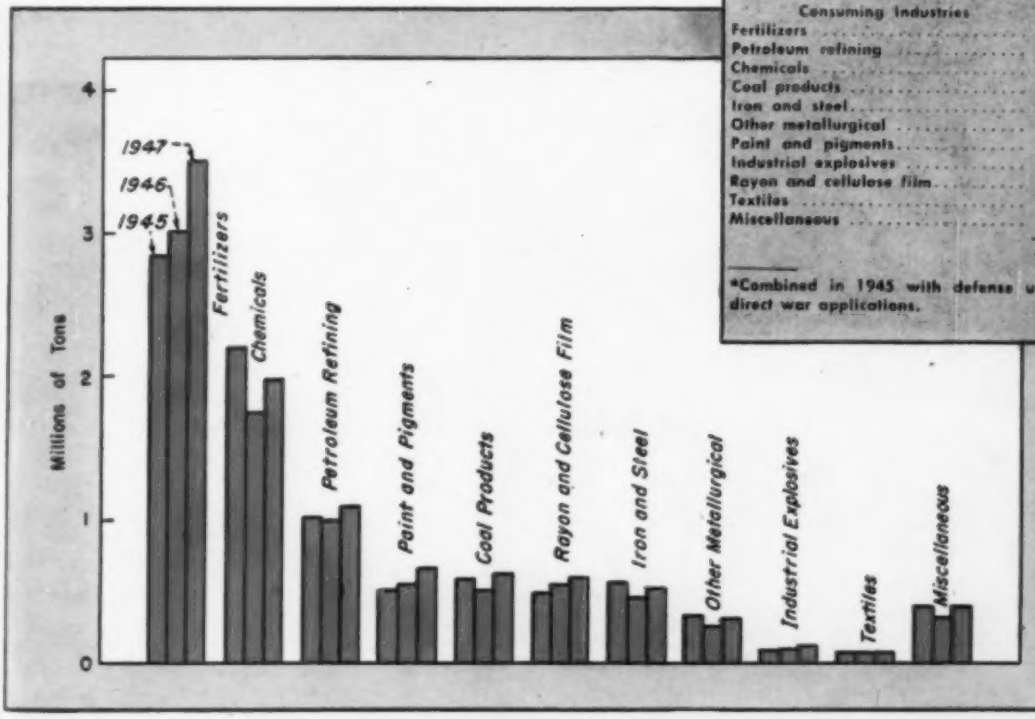
A few technical trends in sulphuric acid manufacture have interesting implications. Although present acid plant construction is largely that of vanadium-catalyst contact plants, nearly all of the "outdoor" type, it is still premature to discuss the demise of the chamber plant. A surprising amount of chamber construction has taken place in the last few years. In spite of the versatility of the contact plant and the present high cost of lead, some 16 plants in the southern and southeastern fertilizer areas have been provided with Mills-Packard type chambers in the last three years. Five of these were new plants, six were old plants in which the box chambers were replaced with Mills-Packard chambers, and five more were box chamber plants to which one or more Mills-Packard chambers were added.

In contact plant construction it is interesting to note that a plant now being completed for the Standard Wholesale Phosphate & Acid Co. in

(*Continued on page 128*)

Consuming Industries	1945 (Revised)	1946 (Revised)	1947
Fertilizers	2,850,000	3,020,000	3,510,000
Petroleum refining	1,020,000	1,000,000	1,065,000
Chemicals	2,220,000*	1,760,000	1,970,000
Coal products	600,000	510,000	630,000
Iron and steel	570,000	475,000	550,000
Other metallurgical	330,000	280,000	315,000
Paint and pigments	520,000	550,000	665,000
Industrial explosives	100,000	105,000	115,000
Rayon and cellulose film	495,000	556,000	610,000
Textiles	70,000	75,000	73,000
Miscellaneous	400,000	320,000	400,000
	9,175,000	8,651,000	9,903,000

*Combined in 1945 with defense uses to avoid disclosing estimates of direct war applications.



SULPHURIC CONSUMPTION

Estimated Distribution of Sulphuric Acid Consumed in U. S., Short Tons, 100 Percent Acid

Alkalis and Chlorine

Demand Still Ahead of Supply;

Ash, Chlorine Struggle to Boost Capacity

ALTHOUGH the alkalis established new records in 1947, the year was not one that brought much satisfaction to either the users or the producers for the story was one of shortages, transportation troubles and continual howls for "more." Like Oliver Twist, consuming industries could not be satisfied. Caustic soda was at times not so tight as soda ash and chlorine but certain new developments were postponed for lack of alkalis, while considerable substitution was necessary, sometimes resulting in other dislocations. An example was the glass industry's employment of much more salt cake than normal, which seriously upset the paper industry. Still, a part at least of the shortage was made up during the year and in some quarters it is believed that further expansions that will be completed in 1948 will permit the industry to catch up with demand before 1949.

It is apparent, however, that alkali demand has by no means reached a level plateau. In reports to Secy. Krug's Committee on National Resources and Foreign Aid the industry anticipated that soda ash capacity would reach 5,200,000 tons in 1948, and 5,700,000 tons somewhere between 1949 and 1952; while parallel figures for caustic soda would be 2,400,000 tons in 1947, and 2,800,000 between 1949 and 1952. These compare with estimates of 4,805,000 tons of ash and 2,080,000 tons of caustic produced in 1947, and would seem to constitute quite reasonable increases. However, if it had been available it is believed that 5,000,000 tons of ash could have been consumed in 1947.

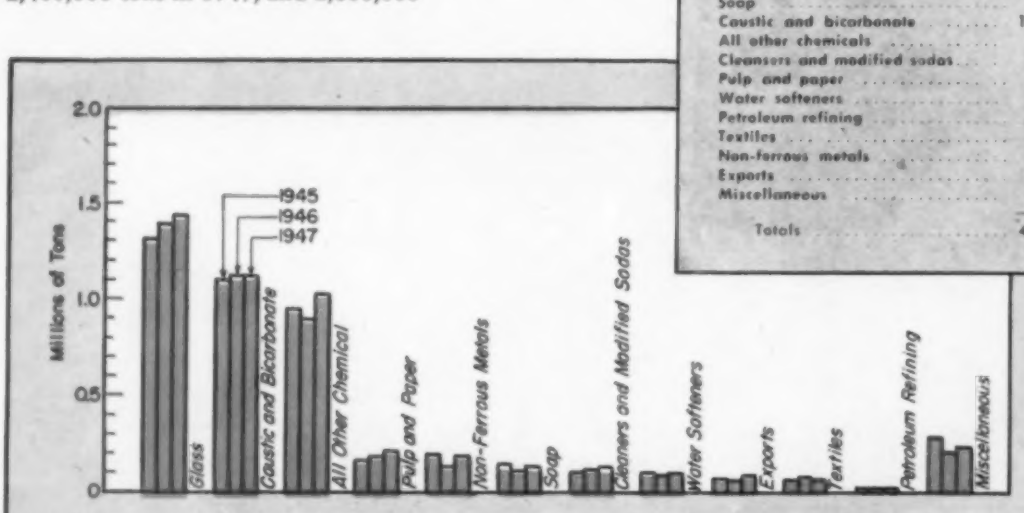
The author of one study of future alkali needs has advanced the idea that the world has left the "iron and steel age" of pre-1920, and is entering the age of light metals, plastics, cellulose derivatives, ceramics, chemicals and synthetics, in which the alkalis will play a much more important part relatively than they have ever played before.

There is some small evidence in support of this belief in the accompanying diagram of soda ash, caustic soda and chlorine production from 1921 to the present. Also the diagram suggests another interesting speculation regarding the future relations of the two caustic soda producing processes. Although the trend line for soda ash is not quite so steep as that for caustic, and considerably less so than the chlorine trend, it is still much more abrupt than the rise of general manufacturing. This indicates that something special has been taking place in the alkalis. If the exact future destination of the trend lines cannot be projected too seriously, still, it is clear that this destination cannot be anything but high so long as business continues its upward course.

The speculation concerning caustic soda sources appears to be somewhat more certain. The caustic line, representing the sum of caustic from both the electrolytic and the lime-soda processes, is obviously not far from an intersection with the chlorine curve. Since about 1⅛ lb. of caustic is made with each pound of chlorine produced in an electrolytic cell, then the chlorine curve can without much error be taken as the curve for electrolytic caustic. Somewhere between 1950 and 1960, it would seem, the electrolytic and total caustic lines are going to intersect!

What this will mean for the lime-soda process is anybody's guess. It is highly unlikely that that process will

Consuming Industries	1945 (Revised)	1946 (Revised)	1947
Glass	1,320,000	1,400,000	1,440,000
Soap	150,000	120,000	135,000
Caustic and bicarbonate	1,114,000	1,128,000	1,130,000
All other chemicals	960,000	910,000	1,030,000
Cleansers and modified sodas	110,000	125,000	130,000
Pulp and paper	175,000	190,000	220,000
Water softeners	100,000	90,000	100,000
Petroleum refining	24,000	20,000	22,000
Textiles	68,000	77,000	71,000
Non-ferrous metals	200,000	140,000	190,000
Exports	70,000	67,000	92,000
Miscellaneous	290,000	223,000	240,000
Totals	4,581,000	4,490,000	4,800,000



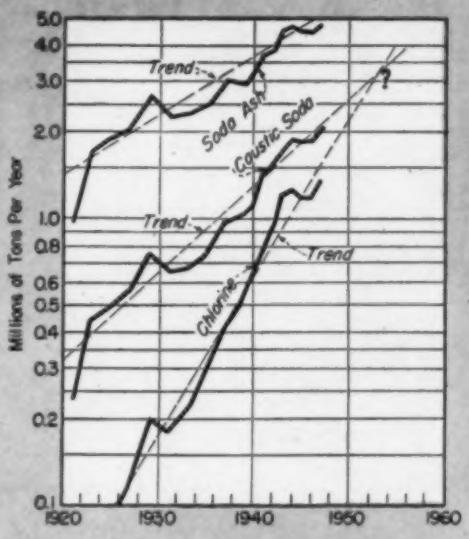
ASH USED

Estimated Distribution of Soda Ash Consumed in U. S., Tons

CAUSTIC U. S. Production, Tons

Year*	Lime-Soda	Electrolytic	Total
1921.....	163,044	75,547	238,591
1923.....	314,195	122,424	436,619
1925.....	355,783	141,478	497,261
1927.....	387,235	186,182	573,417
1929.....	524,985	236,807	761,792
1931.....	455,832	203,057	658,887
1933.....	439,363	247,620	686,983
1935.....	436,980	322,401	759,381
1937.....	488,807	479,919	968,726
1939.....	532,914	492,132	1,025,046
1940 (est)	505,000	595,000	1,100,000
1941.....	685,999	743,316	1,429,310
1942.....	634,291	939,878	1,514,169
1943.....	663,495	1,036,577	1,700,072
1944.....	689,565	1,205,039	1,894,604
1945.....	734,993	1,129,312	1,864,305
1946.....	742,932	1,129,956	1,872,888
1947 (est)	745,000	1,335,000	2,080,000

*Figures for 1921-1946, except 1940 are from the U. S. Bureau of the Census. Prior to 1939 electrolytic caustic soda figures did not include that made and consumed at wood-pulp mills, estimated at about 30,000 tons in 1927 and 1929, at about 24,000 tons in 1931, 21,000 tons in 1933, 20,000 tons in 1934, 17,000 tons in 1935, 19,000 tons in 1936 and 1937, and 18,000 tons in 1938.



CAUSTIC-CHLORINE SQUEEZE PLAY

As production of chlorine soars it turns out co-product electrolytic caustic practically ton for ton. But demand for caustic is not rising that fast. In the middle is the caustic produced by the lime-soda process. By 19__ lime-soda caustic may be squeezed out almost entirely

be entirely superseded, even if the steeper trend line for chlorine should prove successful in predicting the future. On the other hand, it does not seem likely that there will be much additional reliance on non-caustic chlorine processes. Therefore, it is probable that the present almost static trend for the lime-soda process will turn sharply downward in the next decade, with such plants either salvaged for other purposes or largely held in reserve—except of course those in industries such as pulp and paper where they are merely a means of regenerating caustic that has reverted to the carbonate in process.

Statistics of the year show how far behind the alkali industry has left the prewar '30's. Extensive rehabilitation coupled with a good deal of new construction (which, however, is several months behind schedule) enabled the ammonia-soda ash producers to better 1946 by about 235,000 tons, while new facilities of natural soda producers resulted in about 75,000 tons increase. More specifically, estimates for 1947 based on 10 months' figures are 4,520,000 tons of ammonia-soda and 285,000 tons of natural soda, a total of 4,805,000 tons. Comparable figures for 1946 are 4,284,231 tons of ammonia-soda and 209,411 tons of natural soda, totalling 4,493,642 tons. At the previous peak of 1944 the total of 4,538,498 tons included about the same amount of ammonia-soda, but only 179,940 tons of natural soda ash. Kaiser's 100-ton per day Permanente Metals plant at Owens Lake became effective early in the year, but the Westvaco natural soda plant near Green River, Wyo., did not start operations until the end of 1947.

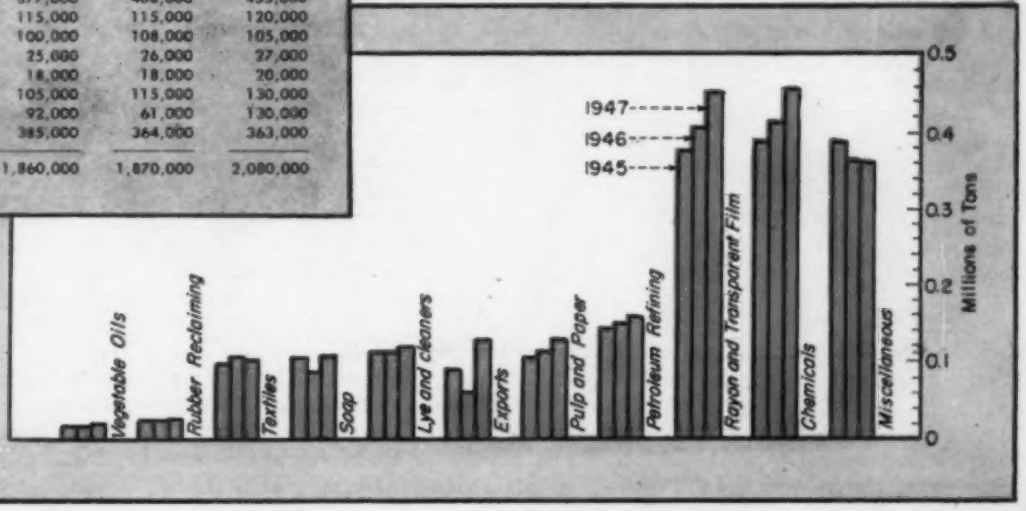
On the consumption end, the 7 percent increase over 1946 indicated in the accompanying tabulation did not tell the entire story so far as the consuming industries were concerned. In several cases users were able through substitutions and economies in the use of ash to increase their output more than their higher ash usage would indicate. Glass, with less than 3 percent more ash, was actually considerably farther ahead, having a record year in flat glass and containers, coupled with a drop in glassware. Use of ash in soap is estimated over 12 percent higher and in chemicals, 13 percent. Pulp and paper showed an in-

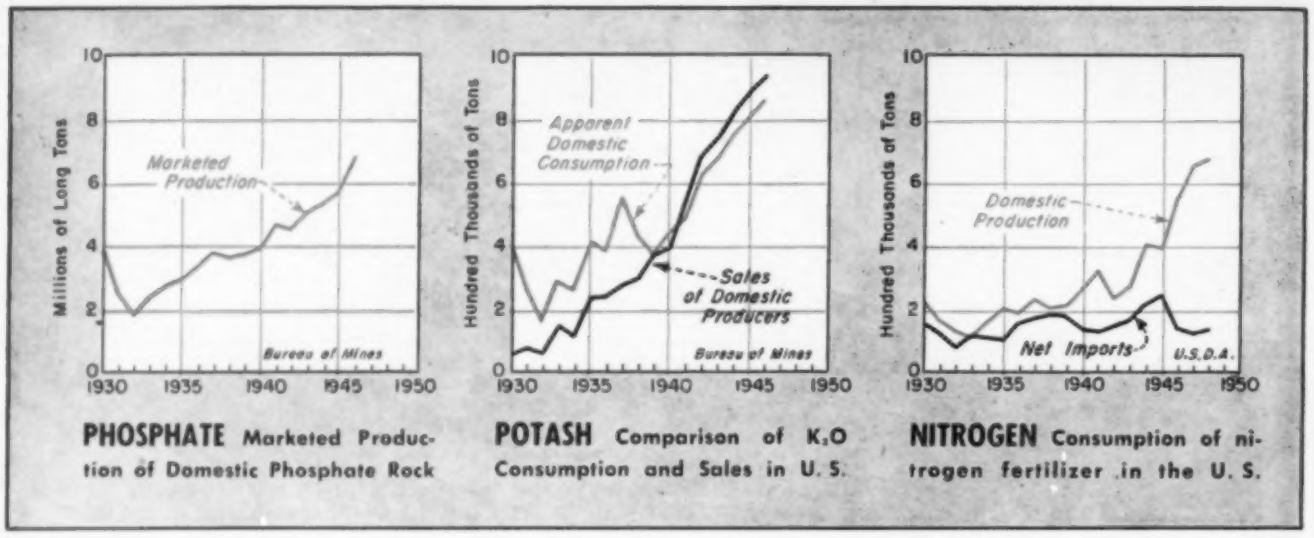
(Continued on page 128)

Consuming Industries	1945 (Revised)	1946 (Revised)	1947
Soap	108,000	90,000	110,000
Chemicals	390,000	415,000	460,000
Petroleum refining	145,000	150,000	160,000
Rayon and transparent film	377,000	408,000	455,000
Lye and cleansers	115,000	115,000	120,000
Textiles	100,000	108,000	105,000
Rubber reclaiming	25,000	26,000	27,000
Vegetable oils	18,000	18,000	20,000
Pulp and paper	105,000	115,000	130,000
Exports	92,000	61,000	130,000
Miscellaneous	385,000	364,000	363,000
Totals	1,860,000	1,870,000	2,080,000

CAUSTIC USED

Estimated Distribution of Caustic Soda Consumed in U. S., Tons





PHOSPHATE Marketed Production of Domestic Phosphate Rock

POTASH Comparison of K_2O Consumption and Sales in U. S.

NITROGEN Consumption of nitrogen fertilizer in the U. S.

Fertilizer Chemicals

Demand Formula: $N + K_2O + P_2O_5 = 1 + 1 + 2$ Million Tons

Supply Formula: 9/10 Scare + 1/10 Scarcity = 10% Short

FERTILIZER production and use were both at record levels during 1947. Slightly higher rates are expected in 1948, certainly in the first half and probably also in the second half of the year. These records of last year and expected higher records of this year were accompanied by comparable records for phosphates, potash, and nitrogen chemicals. Incidentally argument in Washington about fertilizers and these components also was at an all-time high. The argument continues.

Farmers of America used about 16.5 million tons of fertilizers during 1947. The demand appeared much greater; but the actual willingness to buy was probably only slightly greater than the supply. It appears, therefore, that the constant increases in production by the industry are now approaching the point of satisfying the real demand. This fact is obscured by the excessive clamor for larger deliveries in a few areas where unquestionably a significant shortage still exists. But such shortages on the average through the country probably do not exceed 10 percent of the real demand.

Some competent estimators believe that the majority of regions got between 95 and 98 percent of wanted supplies of phosphate and nearly that close to their desire in potash. Much lower percentage of wanted solid nitrogen compounds prevailed; but that was offset by a significant surplus of liquid ammonia and ammonia solutions in certain areas where facilities for converting the ammonia to usable solid forms did not exist.

Supplies

Phosphate rock supplies are now ample to meet all needs except in the case of a few spotty shortages. The difficulty in getting adequate superphosphate continues to be scarcity of sulphuric acid. There seems little likelihood of a material change in that supply in early 1948.

Potash producers have promised about 10 percent more output this year than last. During the latter part of the year the present mere trickle of imports of potash will probably become more significant. No serious scarcity is expected after the end of the present spring planting season. On the other hand, no surpluses or difficulties in prompt sale are anticipated.

All of these comments on adequacy of phosphate and potash might, however, be changed if suddenly there were some feasible method developed for supplying more nitrogen chemicals suitable for mixed fertilizer. The result of that action, should it occur counter to expectation, would be to increase farm demand for all mixed goods and thus increase the demand for the components other than nitrogen, but probably not over 10 percent.

Recently an official study has been made of the capacity of existing superphosphate and fertilizer works. This indicates that there are commercially operable acidifying plants capable of making annually at least 2.5 million tons of available P_2O_5, in normal 18 percent superphosphate. The record production of last year required only about 1.8 million. Fertilizer mixing facilities are comparably large. It is evident, therefore, that nationally the fertilizer-making facilities exceed all prospective requirements by a comfortable margin.

This situation in plant capacity has been achieved by two developments of the war period. Approximately 100 new or substantial-enlargements of plants were built between 1941 and 1947. These had a fertilizer capacity of nearly 1.5 million tons of mixed fertilizer. Many plants which used to operate only seasonally have in recent years been operating for much longer portions of the year. Thus, without material change in daily rating, they contribute much more to the annual business. Both these trends continue, and there seems to be no doubt that the industry is completely justified in its statement to Congress that it both can and will take care of all fertilizer demands as fast as raw materials are available to it.

	1947-48				1950-51	
	Production, Est.	Imports	Exports	Consumption	Capacity, Est.	Max. Production, Est.
United States	1,197[2]	162	288	1,071	1,287[3]	1,287[3]
Canada	170	1	126	45	227	200
Chile	260	..	250	10	320	320
United Kingdom	310	4	74	240	327	327
France	170	59	...	229	350	220
Belgium	161	2	70	93	175	165
Holland	65	40	..	105	222	180
Norway	97	..	75	22	160	160
Italy	130	7	..	137	305	175
Germany	257	135	..	392	512	450
Rest of Europe[1]	160	151⅓	24	287⅓	250	200
Egypt	..	63⅓	..	63⅓	..	..
Japan, Formosa & Korea	240	125	..	365	369	230
Other Countries	43	157	..	200	83	83
Total	3,260[4]	907	907	3,260	4,587	3,997

Source: Aikman (London), Ltd., Annual Report. [1]Excludes Russia and Russian zone of Germany. [2]Includes Ordnance plants of 225,000 tons. [3]Includes Ordnance plants of 315,000 tons. [4]Includes 465,000 tons estimated production for industry.

FORECAST: WORLD NITROGEN Distribution of World Production and Consumption, Thousands of Metric Tons of Nitrogen[1]

Production of specialized phosphate fertilizers continued to increase during 1947. Southern Acid and Sulfur Co. at Houston, Tex., is now regularly making ammonium phosphate at its new plant. It is expected that at least one surplus government property built for other purposes at Salt Lake City will shortly be converted to ammonium sulphate.

New Developments

Several new facilities for making concentrated superphosphate either began operation last year, or are just going into operation this spring. The two largest new plants of this character have been built by Swift and Armour companies in Florida, with combined capacity exceeding 100,000 tons per year of high concentration phosphate. Anaconda operations contemplate increased sale of phosphoric acid for use as such either through irrigation water distribution, or by spreading in solution on the soil. Simplot in Idaho, Westvaco in California, and two phosphate operations in western Montana are talked of seriously.

Treatment of rock for furnace elimination of fluorine without acid has continued in several plants. Coronet in Florida has recently been selling most of its de-fluorinated rock for feed instead of fertilizer. The decline of special phosphates from that source has, however, been offset by increased phosphate produced by Permanente from serpentine. Taken all together the specialized phosphate production now comes from plants having more than 500,000 tons per year of production capacity. Substantially all of this is high-concentration superphosphate, containing about 45 percent available P_2O_5.

Present fertilizer practice of farmers requires about 70 percent of the plant food in mixed goods. The balance is used for single component application as superphosphate, concentrated super, or nitrogen compounds for top dressing or side dressing. It is interesting to note that both in the case of mixed fertilizer and these separately used components the plant-food concentration is about 21 percent of the product put on the soil.

Convenient to remember as a simple picture of the present American fertilizer requirements are the following figures. The United States farmers are now in position to use annually about a million tons of nitrogen, a million tons of potash (K_2O), and two million tons of phosphate (P_2O_5). This combination of four million tons, which represents probable peak demand of the early future, is utilized in nearly 20 million tons of materials. Nearly three-quarters of the total will be mixed fertilizer containing two or three of the main plant foods. Between 25 and 30 percent will be single plant food components distributed as such. For the present crop plantings it is expected that farmers will actually get and use on the land about 90 percent of these totals.

HOW MUCH?

(*Continued from page 103*)

plans. In the all-manufacturing poll, 26 percent would increase budgets, 17 percent would cut, 57 percent would make no change.

If business slumps by 20 percent, 38 percent of the chemical companies and 63 percent of the petroleum industry would continue expenditures as planned. However, 31 percent of chemicals and 23 percent of petroleum would retrench. Others in each group have no plans for 1948 and so did not answer this question. In the all-manufacturing group, 41 percent would make no change, 18 percent would cut back.

5. The chemical and petroleum industries look to stocks and bonds and the commercial banks to raise a substantial part of the money they need for new plants and equipment. Less than 60 percent of the companies in the two groups will raise all the money from profits and surplus. But about three companies in four in the all-manufacturing total will get all their funds from internal sources. In general, industry has a far larger part of the money available from profits and surpluses than most analysts have suspected.

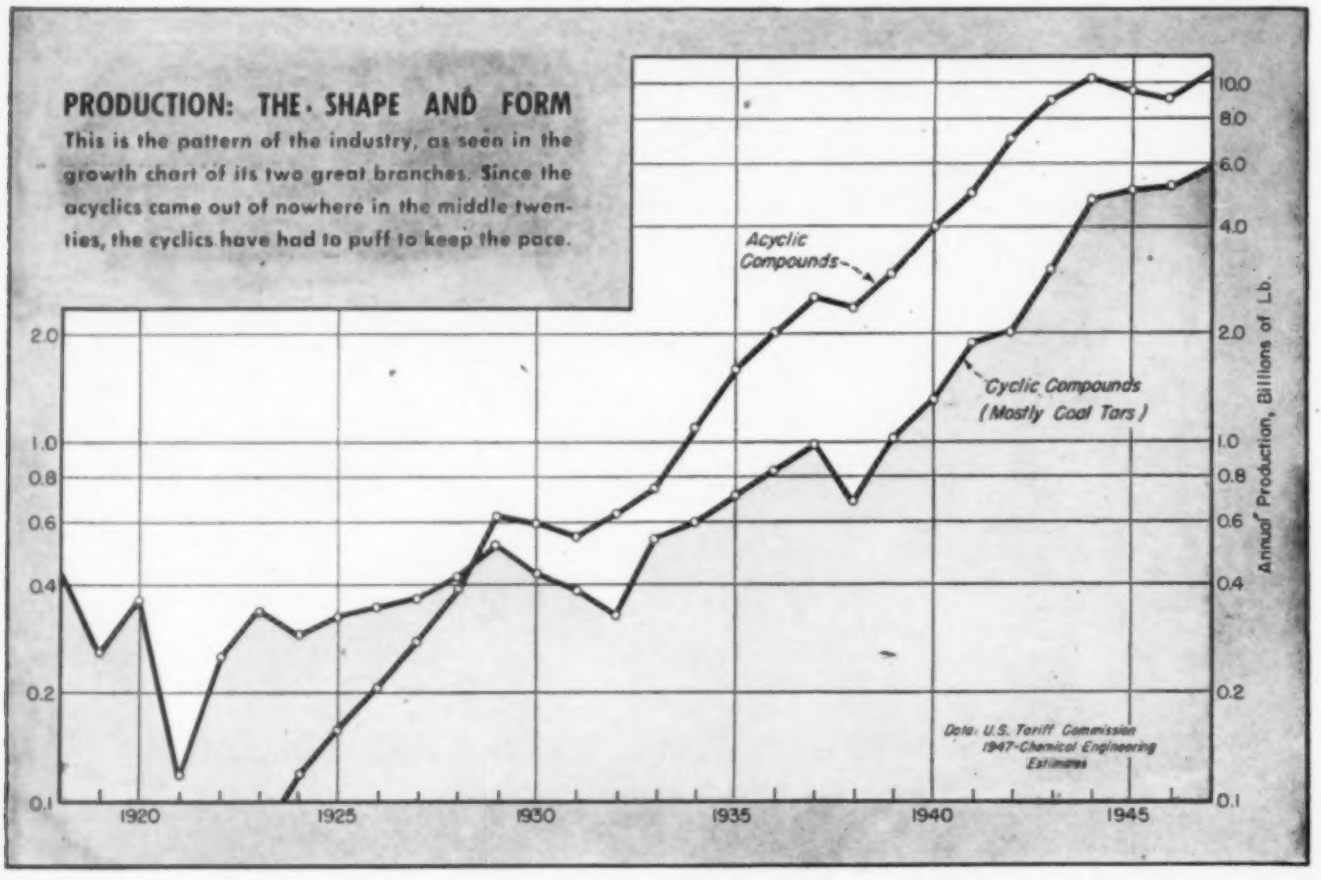
Looking well ahead, 1949 seems brighter for these two industries, particularly petroleum, than it does for manufacturing as a whole. Where 66 percent of all-manufacturing companies expect to have their entire expansion program complete at the end of 1948, 65 percent of the chemical companies and only 26 percent of the petroleum companies expect to have theirs finished. Again this is a reflection of higher obsolescence resulting from new technology—as well as the relatively more rapid growth of these industries.

In planning for 1949, too, 25 percent of the petroleum companies and 22 percent of the chemical companies expect to spend more than they will in 1948. Only 17 percent of all manufacturing industries see their expenditures increasing next year. It is still possible, of course, that the march of events will lead businessmen to continue spending huge sums for new plants and equipment in 1949. But to count on that kind of blind luck is to run a very great risk of a painful business slump in 1949. A far wiser course would be to do everything in our power during the coming year to keep business from hitting the skids in 1949.

Synthetic Organic Chemicals

Snaps Out of Doldrums, Triples Prewar Production;

New Plans But Still No Plants for Fischer-Tropsch; DDT, BHC Means Business



EXCEEDING the wartime peak of 1944, synthetic organics have come out of the postwar dip to reach a new high in both production and sales. The year 1947 saw synthetic organics total production near the 8¼ million ton mark; in comparison, the 1940 total was only 3 million tons. Looking forward, the first half of 1948 will see production rates unprecedented in the history of the industry. This year should set a record total of over 9 million tons.

Developments during the past year follow trends that started during the war. These include greater use of petroleum and natural gas as a chemical raw material and growing importance of such branches of the industry as pharmaceuticals, insecticides and synthetic detergents. Important groups such as petrochemicals, pharmaceuticals, coal chemicals, plastics, synthetic fibers, and solvents are discussed individually in subsequent pages.

Most important development to affect synthetic organic chemicals will be the commercial application of the Fischer-Tropsch process in synthesizing gasoline and oxygenated organic compounds from natural gas and coal. Preliminary estimates of the quantities of organic chemicals to be turned out leave little doubt as to the impact of this development on existing processes. Significant here is the fact that U. S. Industrial Chemical has tied in with Carthage Hydrocol and Stanolind to market the chemical products of this process. Although contracts for construction of these plants were awarded over a year ago, there hasn't been much in the way of building activity so far. Standard Oil Development Co. and Pittsburgh Consolidated Coal Co. joined forces in 1947 to develop commercial manufacture of synthetic fuels from coal via Fischer-Tropsch. The Bureau of Mines has worked on all phases of this problem with emphasis on coal hydrogenation.

Most of the large tonnage synthetic organics achieved record production in 1947 but were unable to meet all requirements. Further expansion is taking place to alleviate shortages. Du Pont and Commercial Solvents have increased their methanol facilities while both Solvay and Spencer Chemical are reported to be entering the methanol field this year. Estimated production for 1948 should be about 110,000,000 gal. Major uses of methanol are for anti-freeze and formaldehyde.

Main competitor of methanol as an anti-freeze is ethylene glycol. Al-

Table I—Production of Certain Synthetic Organic Chemicals in U.S.[1]

	1939	1943	1944	1945	1946
Acetic acid (100%)	119,653	292,541	292,611	267,518	285,452
Acetic anhydride	181,156	460,426	495,522	524,748	521,911
Acetone		347,624	328,428	307,363	335,584
Butyl acetate, normal (90%)	77,734	64,319	69,987	67,461	93,839
Butyl alcohol, normal (100%)	72,737	128,999	150,320	129,364	126,233
Carbon bisulphide		272,568	291,807	335,056	319,436
Carbon tetrachloride	90,536	175,316	209,802	192,826	148,674
Chlorobenzene (mono)		220,659	212,455	237,667	268,912
Ethyl acetate (85%)	69,897	103,600	108,196	105,814	88,799
Ethyl ether		65,847	76,192	76,598	38,970
Ethylene glycol		186,834	202,451	205,087	192,176
Formaldehyde (37%)	134,479[2]	522,920	522,440	509,602	458,877
Isopropyl alcohol (100%)	179,062	376,065	480,772	490,997	542,997
Methanol (100%)		432,000	472,686	493,110	509,820
Phthalic anhydride		114,118	122,723	125,033	112,746
Phenol		181,347	173,141	181,640	183,855
Plasticizers, total[3]	29,861	136,153	186,745	169,269	114,596
Surface-active agents, total[3]		114,360	152,636	161,540	239,197

[1]From U.S. Tariff Commission and Bureau of Census. All figures given in thousands of lb. [2]Reported as 40% by weight. [3]Total of both cyclic and acyclic compounds.

Table II—Production of Certain Cyclic Synthetic Organic Chemicals in U.S.[1]

	1939	1943	1944	1945	1946
Intermediates	607,175	1,637,275	2,143,305	2,326,921	2,547,485
Dyes	120,191	144,013	151,653	145,213	186,307
Colors, lakes, toners	18,154	16,317	19,197	23,117	32,316
Medicinals	15,188	51,633	35,353	39,107	36,099
Flavors and perfumes	5,349	9,559	11,726	12,719	10,981
Rubber processing chemicals	29,966	61,710	73,774	80,080	80,129

[1]From U.S. Tariff Commission and Bureau of Census. All figures given thousands of lb. Cyclic compounds shown in this table are mostly derived from coal tar.

PRODUCTION: THE SOUND AND FURY These are the headliners, the stealers of the limelight, within the family of synthetic organics

ready made by Carbide & Carbon, Du Pont and Dow, 1947 saw Wyandotte's new plant and Dow's Sarnia, Ontario, plant go into production. Jefferson Chemical is starting its plant early this year. Ultimate production capacity is probably near 375 million pounds. When the anti-freeze market is saturated this commodity should find use as an intermediate or raw material.

Resins and plastics have pushed formaldehyde requirements to a new high. Dominated by Celanese, Heyden and Du Pont, new formaldehyde capacity is either underway or being planned. Durez Plastic & Chemical Co. and Casein Corp. have already started new plants while Monsanto, Reichhold, Du Pont, and Commercial Solvents are also expanding. Since a bulk of the new capacity depends on oxidation of methanol, actual output depends on methanol availability.

Coming into importance is maleic anhydride. First made in 1919, production in 1945 had grown to only about 4,000 tons. Increased use in alkyd resins is back of current expansion which is expected to more than triple the 1945 output. Major production is from benzene by the catalytic oxidation process used by National Aniline. Monsanto has produced some maleic as a byproduct in phthalic anhydride manufacture, but is building a new unit for producing maleic alone. Carbide & Carbon makes it from hydrocarbons and their derivatives. Reichhold recently started its new plant at Elizabeth, N. J.

Only ten years ago synthetic organic chemicals represented less than 2 percent of the total dollar volume sales of insecticides. A different story holds today with just two of the many synthetic organics in this field accounting for over 15 percent of an estimated total for 1947 of 250 million dollars.

DDT is still Mr. Big of the synthetic insecticides. Made first in 1944, the 1946 production of 21,000 tons sold for over 17 million dollars. Penn Salt started making DDT in Portland, Ore., in mid-1947 while Stauffer started its plant in California. While production continued at record levels the first half of 1947, it was cut back in the second half due to an over supply. Hope is that greater exports, new uses and wider application of established uses will take up much of the slack in the future.

Number two of the synthetic insecticides is benzene hexachloride. Developed first in England as Gammexane present manufacturers in this country include Stauffer, Du Pont, Commercial Solvents, Penn Salt, Westvaco, Hooker, and General. In 1947, monthly production grew from 147,833 lb. in January to 1,052,635 in October. Most important application is in combating the cotton boll weevil. BHC is toxic and has been found to transmit its odor and taste to certain food crops such as potatoes. Despite any limitations such as this, it will continue to expand for non-food applications.

Other outstanding new insecticides on the market are chlordane made by Velsicol and by Julius Hyman. It has been most successfully used against cockroaches. Tetraethyl pyrophosphate made by Monsanto and diethyl p-nitrophenyl thiophosphate made by American Cyanamid were both developed in Germany. For destroying mites, aphids, etc., they are most promising. A variety of fungicides and weed killers have reached the market in the last couple of years. Best known is 2,4D which has reached a sizable tonnage. Main producers are Sherwin Williams, Du Pont and Dow.

Synthetic detergents have experienced unprecedented expansion. Practically all the large soap companies are participating in this growth. Biggest producer, however, is still National Aniline with its Nacconals. Largest producer from petroleum is Oronite in California.

Ultimate annual production in 10-15 years is estimated as high as 1.5 million tons.

Rubber Situation

Political considerations still affect the rubber situation. During 1947 consumption of natural rubber exceeded that of synthetic for the first time since 1933. Present estimates for 1948 usage are: 550,000 long tons of natural and 335,000 of synthetic.

Petrochemicals

Industry Bursts Out of Talk Stage, Stampedes to Construction; Next Year, Some Real Production

GULF COAST

ANNOUNCED construction plans and construction actually begun during the last 12 months make it certain that 1948 will witness an unparalleled production of chemical intermediates and finished chemical products from petroleum and natural gas in the Southwest. Hardly a month passed last year without some announcement of plans to manufacture more petrochemicals. Several new companies were preparing to go into production. About a dozen established organizations were either expanding current output or installing facilities to manufacture new lines. Design work or actual construction was under way or completed for plants using processes never before applied commercially.

Significant Developments

It would be difficult to decide what development in the petrochemicals field last year was the most significant. Too many new products with potentialities for wide application emerged to warrant a dependable guess, and one or two new processes promising to yield familiar products at materially lower costs are yet to get into production. All such processes have not been disclosed, but two which are on the way to commercial use may be mentioned: the radically modified Fischer-Tropsch process yielding oxygenated chemicals and the Schoch "glow discharge" electrical process for manufacturing acetylene and other chemicals from natural gas.

Scheduled for completion in 1949 or 1950 are the plants of Stanolind Oil & Gas Co. in the Hugoton Field in Kansas and Carthage Hydrocol near Brownsville, Tex., to produce synthetic gasoline and byproduct chemicals by catalytically synthesizing carbon monoxide and hydrogen by processes far superior to the original Fischer-Tropsch method. Perhaps the gasoline should be called the byproduct, for the output from the two plants will be but a minute fraction of total domestic production, whereas the production of some of the acids, aldehydes, ketones and alcohols that can be recovered will materially affect the markets.

Last October Eugene Ayres, Director of Research, Gulf Reseach and Development Co., told the Chemical Market Research Association that ". . . it is estimated that if only one-fifth of the country's motor fuel were made by this process, the byproduct ethyl alcohol would amount to 200 million gal. per annum—about the present total production of the United States." He added that "Even the two 5,000 bbl. per day plants now planned (which would make only 0.5 percent of the country's motor fuel) should have an appreciable effect on the alcohol market." Also, "It would be surprising if such processes did not eventually displace many of the conventional chemical operations."

The announcement last year that U. S. Industrial Chemicals and Stanolind Oil & Gas Co. will build facilities at the two plants in Kansas and Texas to separate and utilize the total production of water-soluble oxygenated chemicals was one of the most important developments. Total production from these plants has been estimated as much as 300 million pounds per year. The major components are regarded as ethyl alcohol, normal propyl alcohol, acetic acid, normal butyric acid, propionic acid, acetone and acetaldehyde. It will probably be several years, however, before these chemicals and their derivatives hit the market.

Although less spectacular than the above, the disclosure a few months ago that the Houston Oxygen Co. will build at Houston, Tex., a plant to utilize commercially for the first time the Schoch process for manufacturing acetylene was noteworthy. The process is regarded as applicable not only to acetylene production but to other chemicals. Last October at the University of Texas Schoch indicated that the pilot-plant work on acetylene was coming to a close and probably would be turned into other lines of investigation. The Houston Oxygen Co. plant is expected to be completed some time this year.

For sheer magnitude of new construction to manufacture chemicals from petroleum, Shell Chemical Corp. at Houston apparently led the procession during 1947. Today the Houston plant is swarming with construction crews and is seemingly a chaotic tangle of new construction, which characterized the premises all last year. Shell Chemical is in the midst of an expansion program reaching at least $30 million. Its expansion was an important factor in the decision of Diamond Alkali Co. to build nearby the caustic-chlorine plant coming into production in a month or two.

As the result of construction which began last year Shell will soon score another achievement in the field of petrochemicals when it completes its plant at Houston to manufacture synthetic glycerin from propylene by a process developed by Shell some years ago. Also scheduled for completion this year at Houston are plants for manufacturing hexylene glycol and ethyl alcohol.

Construction Majors

Referring further to the "majors" in construction undertaken or completed last year, Carbide and Carbon Chemicals Corp. at Texas City, Tex., and Celanese Corp. at Bishop, Tex., have continued the pace they set in earlier periods. Carbide disclosed last October that it would begin construction of equipment to produce Vinylite resins. Now under way, this project is part of a $15 million program requiring two or three years. Last spring the company put into operation facilities for the production of ethylene amines, The Texas City plant's range of petrochemicals includes ethyl alcohol, isopropyl alcohol, acetone, acetic acid, acetic anhydride and ethylene glycol.

Celanese at Bishop continued extensive additions to its plant.

At Orange, Tex., Du Pont was well along in the construction of a synthetic methanol unit, and less advanced was a plant to manufacture

polythene. Monsanto launched into the tragic wreckage of its plant at Texas City and began the reconstruction of its styrene facilities. At Houston, Rohm & Haas continued work on its plastics plant with expectation of completing it this year. Dow Chemical Co. at Freeport, Tex., was building a second unit for the production of ethylene. Commercial Solvents is putting into operation this year near Sterlington, La., facilities to manufacture synthetic methanol. Last year Humble Oil & Refining Co. in its Baytown refinery began manufacturing normal hexane, heptane and octane fractions from naphtha for use as solvents and was using its hydroformer to produce toluene and xylenes for solvents as well as aviation gasoline.

New Entries

The new entries on the petrochemical stage were Jefferson Chemical Co. and McCarthy Chemical Co. Jefferson's plant at Port Neches, Tex., to manufacture ethylene oxide and ethylene glycol was virtually complete by December. McCarthy began construction at Winnie, Tex., to manufacture aromatics and unsaturated hydrocarbons, and expects to get into initial production before summer. The company will produce ethylene by the dehydrogenation of ethane with use of a new catalyst. Secondary products, such as formaldehyde, will be produced. Aromatics will be obtained by the aromatization of aliphatic hydrocarbons.

The Outlook

As to the future, this year and beyond, there is every reason to look for continued rise in production of petroleum-based chemicals and the multitude of derivatives. The supply of basic raw materials, of which petrochemicals currently require only one percent or less, is abundant for this purpose, despite the growing pinch of domestic crude. New manufacturing capacity under construction will materially increase the proportion of some important chemicals which are being made from petroleum and natural gas. This proportion was already large last year. Several authorities quoted production figures indicating that of total domestic production 50 percent of the ethyl alcohol, all the isopropyl alcohol, 35 percent of the normal butyl alcohol, 90 percent of the amyl alcohol and 75 percent of the acetone come from such sources. Looking at the general picture, W. P. Gage of Shell Chemical Corp. said last fall that the production of synthetic organic chemicals from petroleum sources has reached the point where it amounts to some 30 percent of total output.

Among companies making new expenditures and plans for work in the petrochemical field last year was California Research Corp., which undertook the construction of a new laboratory building at El Segundo where its investigations will be centralized. Cities Service established the Cities Service Research and Development Corp. to handle this type of work, including gas synthesis. Stanolind Oil & Gas Co. set up a Chemical Products Department to handle development and marketing. At El Dorado, Ark., Lion Oil Co. established a Chemical Research Department to explore the commercial possibilities for manufacturing a group which includes formaldehyde, urea, methanol, plastics, dyes and insecticides.

The list is merely indicative, not exhaustive by any means. It serves to indicate the general and growing interest in the subject. The increasing amount of investigation makes it certain, on the basis of past performance and the relative youth of the petrochemicals field, that new commercial developments and expanding production will proceed at a rapid pace.

WEST COAST

Oronite Chemical Co. began producing dry synthetic detergent of the alkyl aryl sulphonate type early in 1947. Production of dry product will exceed 3 million pounds monthly. Production of the slurry form was begun in the autumn of 1946 at the plant at Richmond, Calif. The firm, already stated to be the country's largest producer of synthetic detergent basic material, plans ahead to a total manufacturing potential of 300 million pounds or more annually (all types, liquid and solid). This would represent 30 percent or more of the estimated market to be reached by synthetic detergents, as a class, within the next few years. The product is made from petroleum raw materials without the use of any vegetable fats or oils.

In 1946 Oronite began producing phthalic anhydride in a new plant at Richmond, Calif. It was the first plant of its kind to use ortho-xylol instead of napthalene as raw material. In 1947 Oronite announced an expansion, already under way, that would increase output by 50 percent. It is the only phthalic anhydride producer in the West.

In addition, Oronite produces polybutenes, ortho-, meta- and para-xylols, cresylic and naphthenic acids, sodium sulphonates and mercaptans—all from petroleum raw materials.

Shell Chemical Corp. was one of the pioneer producers of petrochemicals in this country. Petrochemical plants are located at Martinez and Dominguez, Calif. During the past few years most of Shell's petrochemical expansions have been taking place in Texas. These plants, designed primarily to supply eastern markets, are of great importance to the West, for they will release more of the output of the western plants to the expanding western markets. Previously, output of these plants was shipped largely to the East.

In 1947 Shell Chemical increased output of isopropyl alcohol at Dominguez and tertiary-butyl alcohol and diisopropylamine at Martinez. It also doubled facilities to make NH_3 from natural gas at Shell Point and announced plans for a further 50 percent increase in 1948 (if such use of natural gas is considered a petrochemical development). In 1947 the firm also had under construction or development, facilities for making di-tertiary-butyl peroxide and an alkylated phenol at its Martinez plant. In mid-1947, Shell ceased production of butadiene for synthetic rubber at Los Angeles.

In addition, Shell is a large producer on the West Coast of methyl ethyl ketone, acetone, diacetone alcohol, isopropyl ether, mesityl oxide, methyl isobutyl ketone and sec-butyl alcohol (at Dominguez) and of acetone, isopropyl alcohol, methyl ethyl ketone, methyl isobutyl carbinol, methyl isobutyl ketone, sec- and ter-butyl-alcohol (at Martinez).

Union Oil Co. of California increased (at Wilmington, Calif.) output of hydroperoxides and mercaptans. It also produces large quantities of refined paraffin waxes at Oleum, Calif., and has announced a similar plant for Wilmington.

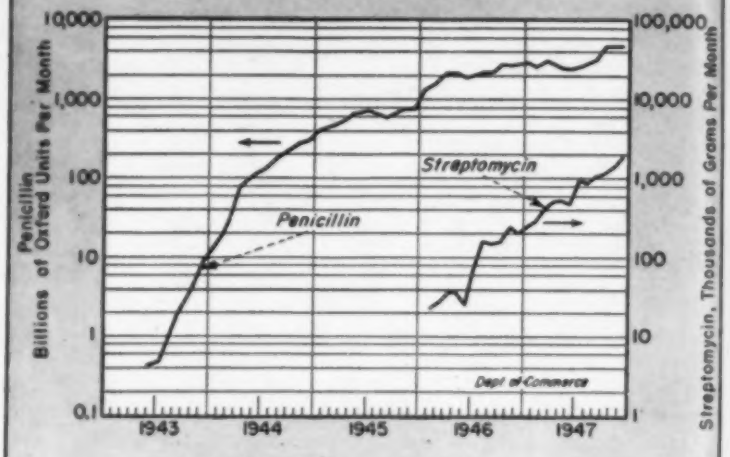
General Petroleum Corp. at Vernon, Calif., is a large producer of naphthenic acids and metal naphthenates.

Portland Gas & Coke Co. is increasing facilities for benzol, toluol and other byproduct chemicals in Portland, and Seattle Gas Co. is installing similar facilities in Seattle. Petroleum is the raw material instead of the usual coal tars.

	Production 1,000 lb.[1]	Value[2] $1,000
Acetophenetidin (phenacetin)	1,470.3	1,290.0
Acetylsalicylic acid (aspirin)	9,926.3	3,949.1
Caffeine (from theobromine)	707.1	2,420.1
Penicillin	27,415.2[1]	89,651.5
Streptomycin	1,132.1[1]	6,019.4
Sulfa drugs (total)	5,103.6	23,356.7
Theophylline ethylenediamine	142.6	1,338.7
Vitamin B_1	185.3	12,984.1
Vitamin B_2 (riboflavin)	44.6	2,938.2
Vitamin B_6 (pyridoxine)	10.3	3,355.5
Vitamin C (ascorbic acid)	727.3	9,576.6
Niacin and niacinamide	1,000.8	3,433.6

Data: U. S. Tariff Commission. [1]Penicillin reported in billions of Oxford units, streptomycin in thousands of grams. [2]Dollar value is given for bulk sales and does not correspond exactly with production.

THE GALAXY . . . Production and Value of the Prominent Synthetic Medicinals, 1946



. . . AND ITS METEORS Phenomenal Rise of Streptomycin, Penicillin Production

Pharmaceuticals

Antibiotics—Busier Bugs Pay Off

Antihistamines—So Does Hayfever

PACING pharmaceuticals, the antibiotics continue to break production records almost month by month. This phenomenal rise, however, hasn't resulted from physical expansion alone. Mainly responsible for 1947's growth of both penicillin and streptomycin is improved yields.

Improved yields not bigger plants is the answer. Take Merck's streptomycin plant for example. Designed for 100,000 grams per month, by the time it had operated a year production was upped to many times designed capacity. More productive strains of microorganisms, better nutrients and more efficient recovery were responsible for improved yields. It's research and development that pays off here. Prediction is that producers with small research appropriations will find the going tough in tomorrow's competition.

Biggest producers of penicillin are Pfizer and Commercial Solvents. Major new plant in 1947 was Lilly's, although many manufacturers increased output. 1948 should see Parke-Davis start large scale production while Merck will increase output with a new $1,500,000 plant in Elkton, Va. Most of the current output is crystalline penicillin G, first made in quantity by Commercial Solvents in 1946. Newest development is procaine penicillin by Pfizer; it stays in the blood stream longer.

Streptomycin production is still dominated by Merck but Pfizer, Squibb and others are becoming increasingly important factors. Merck is spending $400,000 for additional finishing and packaging facilities to take care of increased output. Lilly will increase production by converting the Curtis Wright property in Indianapolis to a fermentation plant. Pfizer has leased the government-owned biological warfare plant at Terre Haute and will there expand its antibiotic production. Heavy exports and increased domestic consumption are back of current expansion.

While it is doubtful if penicillin and streptomycin will be approached volumewise, the over-all field of antibiotics will continue to grow. Promising antibiotics claiming attention include bacitracin, subtilin, polymixin, and chloromycitin. They are being produced in laboratory or pilot plant.

Production of sulfa drugs has stabilized at around 5,000,000 lb. per year. Biggest producer is Calco Chemical, with Monsanto next. A large number of producers were in this field during the war but some of these are dropping out. While sulfas were replaced to some extent by penicillin, they are still widely used. A variety of sulfas are available and most manufacturers turn out special compounds that have unique properties. Sulfas are easy to apply and many of their earlier disadvantages have been overcome by development of newer compounds.

Antihistamines are now making history in treatment of allergies such as hayfever. First to capitalize on antihistamines was Parke-Davis with Benadryl in 1946. Ciba Pharmaceutical followed in 1947 with Pyribenzamine. Sales in 1946 were over $5,000,000 and grew in 1947 to near $15,000,000. 1948 should see more intense competition when Merck, Abbott and others come into production with sales likely to go over $20,000,000.

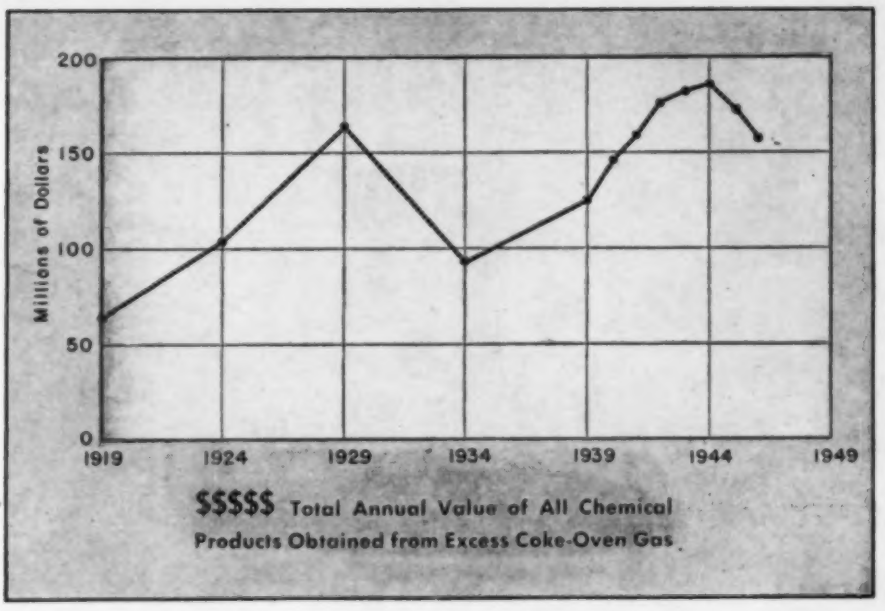
Last November Calco Chemical started up its new Willow Island, W. Va., plant where, among other things, folic acid is made. Extensively used to treat such ailments as macrocytic anemia and sprue, this new compound (B-complex group) is expected to find a variety of new applications.

Two new antimalarials have entered the field to compete with quinine and atabrine. Chloroquin or SN 7618 is made by Winthrop and Chlorguanide, first introduced in England under the name Paludrine, is being investigated by a United States chemical manufacturer.

In narcotics, a German-developed, pain-relieving drug Amidone has been studied extensively and has been found to be less habit forming than morphine. Lilly and Winthrop are most active here.

Coal Chemicals

Cokers Push Capacity; Refiners Stretch Crudes



COAL chemicals were produced during 1947 at near capacity rates. Comparable production is expected throughout 1948 and probably for several years more. So long as the demand for steel continues to exceed supply, the need for coke will be equally pressing and the production of coal chemicals as byproducts will continue.

During 1947 nearly 500 new coke ovens began operation and somewhat more than that were under construction at the end of the year and expected to begin operation in 1948. Some of the old ovens in Alabama were dismantled during the last year. At the beginning of 1948 approximately 14,800 coke ovens were being operated. Their rated capacity exceeds 75 million tons of coke per year. Actual operation currently exceeds 92 percent of rating; and thus nationally it is the maximum normally obtainable except for short spurts.

Major primary byproducts during the past year were, as always, tar, ammonium sulphate, crude light oil, and gas. It is expected that when the final returns for the year are available we shall find that each of these commodities made an all-time record, or close to that. This does not necessarily prove that the sales for further processing or use will also be above previous highs. In some cases the demand for fuel was so great that somewhat less tar and oven gas was sold, in order that the producers could use more in their own metallurgical and steam-raising operations. However, all of the ammonia products, practically all of the light oil, and almost the usual percentage of tar and gas were either processed for secondary products or sold to the usual consumers.

One fact should be recalled in considering average yield of coal chemicals. This is that certain byproducts are not produced in the highest relationship to coal treated when ovens are being operated at high speed. Hence the yield of some of these products, notably ammonia, falls off slightly when the ovens are being pushed at a maximum rate. The total quantity is, however, increased, since the yield per ton falls off more slowly than the tonnage treated rises.

Trends in the cost of coke and value of coal chemicals continued upward during the past year. The recent and the prospective increases in the freight on coal probably will further accelerate these relative dollar values so that the net cost of coke at the blast furnace may well continue to rise, to the annoyance of the steel industry.

The value of coal chemicals recovered in 1919 was about 28 percent of the total value of all products, including coke. Ten years later the chemical values had increased to nearly 37 percent of the total; but since then have declined so that now they represent only about a quarter of the total value of all products. This result comes from the fact that there are other sources of ammonia, synthetic processes for making organic coal products, like those produced from light oil and tar, and less freedom in pricing for coal chemicals than for coke, which the steel men must have from these ovens. It appears that for some time to come the increases in cost for coal and the increases in oven operator wage rates must be absorbed almost wholly in the price of coke.

Refining of primary coal products by the oven operating companies has increased substantially during the war period. Furthermore, the variety of this refining to make high-grade coal chemicals has shown a strong uptrend, also. In prewar years motor benzol constituted about three quarters of the total output from light oil. Now approximately 80 percent of the benzol is of chemical grade and only a small amount is "motor benzol." Even this latter goes largely into chemical usage rather than motor-fuel blending. Recovery of special products, such as dicyclopentadiene, pyridine bases, and other products is becoming common in the oven refinery plants.

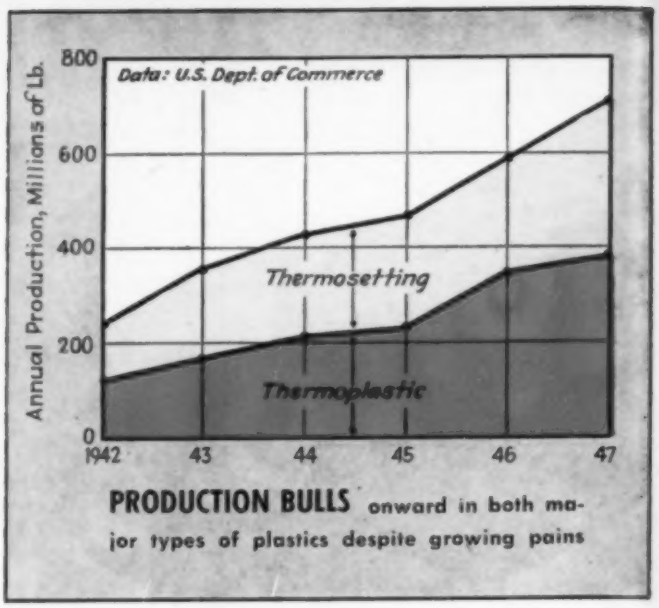
Finer Refining

Comparable trends are noted in coal-tar processing. A larger percentage of total production is refined and substantially wider variety of products is made. This has gone so far that in many cases oven-plant operators are buying heavy petroleum products on a substantial scale to permit more nearly complete use of primary tar in their refineries.

Such chemicals as pyridine and its homologues, present in little more than trace concentrations in the gas, have received increased attention during the year as a result of the critical demand. One company has met the new interest in recovery of pyridine bases by adapting a low differential saturator for recovery of greater quantities of the pyridine bases from the gas. One plant which has been modernized with such a saturator using a 4-in. seal has been able to increase pyridine recovery about 20-50 percent over that previously obtainable from an old-style deep seal saturator.

Plastics and Synthetic Resins

Thermoplastics Drop, Bounce to New High; New Products Try Wings, Oldsters Soar



Although thermosetting plastics continued their steady growth in 1947, the thermoplastics end of the industry suffered growing pains early in the year. The slump which occurred in thermoplastics demand could be attributed in part to the bringing in of new production capacity and reduction of high inventory stocks on the part of fabricators and sellers. A portion of the sales decrease has been blamed on the misapplication of plastics materials by fabricators. This situation eased in the fall and by year end sales were at record heights. Thermosetting resin consumption was held down by limited supplies of essentially all the basic raw materials, particularly phenol, urea, and formaldehyde. Even so, production exceeded any previous year.

New Resins, New Uses

There were new resins introduced and new uses found for older materials. Perhaps one of the most volatile in development of new applications was the vinyl chloride group. To obtain thin, non-cracking films two new compositions were introduced. The first of these is a blend of polyvinyl chloride with GR-N synthetic rubber, the co-polymer of acrylonitrile and butadiene. Goodrich's Polyblend is an example of this type of resin. Bakelite is now selling fabricated films of similar material. Such films are manufactured by solvent casting. A new type of water dispersed vinyl latex, Geon Latex 31X, was marketed by Goodrich. This latex produces thin films by casting. Containing no plasticizer, films from either the latex or the vinyl-GR-N blends have found initial application in food packaging. One of the large potential uses is in packaging of oleomargarine. Both the latex and GR-N blend have other outlets.

In other fields the vinyl chlorides continued to increase in demand. Phonograph records utilizing plasticized polyvinyl chloride continued to find increasing favor. The production of flooring material was begun on a commercial scale. Here plasticized polyvinyl chloride replaces scarce and expensive linseed oil. This field can take tremendous quantities of vinyls.

Capacity for polyvinyl chloride production has been considerably increased. Goodrich and Bakelite continue to dominate the market but the Glenn L. Martin Co. started production from its new unit at Painesville, Ohio. Capacity is reported at 25 million pounds per year. Total vinyl resin production at year end was at a rate of over 200 million pounds per year. Forecasts of demand in the next few years are reported as high as 500 million annual pounds.

Polystyrene production was handicapped by the slump in thermoplastics sales and also by the destruction early in the year of the Monsanto styrene plant at Texas City. Despite its troubles, polystyrene consumption was approaching a 150 million pound annual rate at year end.

Polyethylene continued to increase, aided by several price reductions. Toward the end of the year blown bottles of polyethylene were introduced by Plax. These are finding favor for packaging cosmetics and such acids as hydrofluoric. New polyethylene capacity is expected in 1948.

Among the new monomers introduced during the year was diallyl phenyl phosphate. Victor Chemical Co. is marketing this material under the tradename V-Lite. A colorless liquid, it polymerizes to a transparent thermosetting resin. It may be co-polymerized with such other monomers as methyl methacrylate and vinyl acetate.

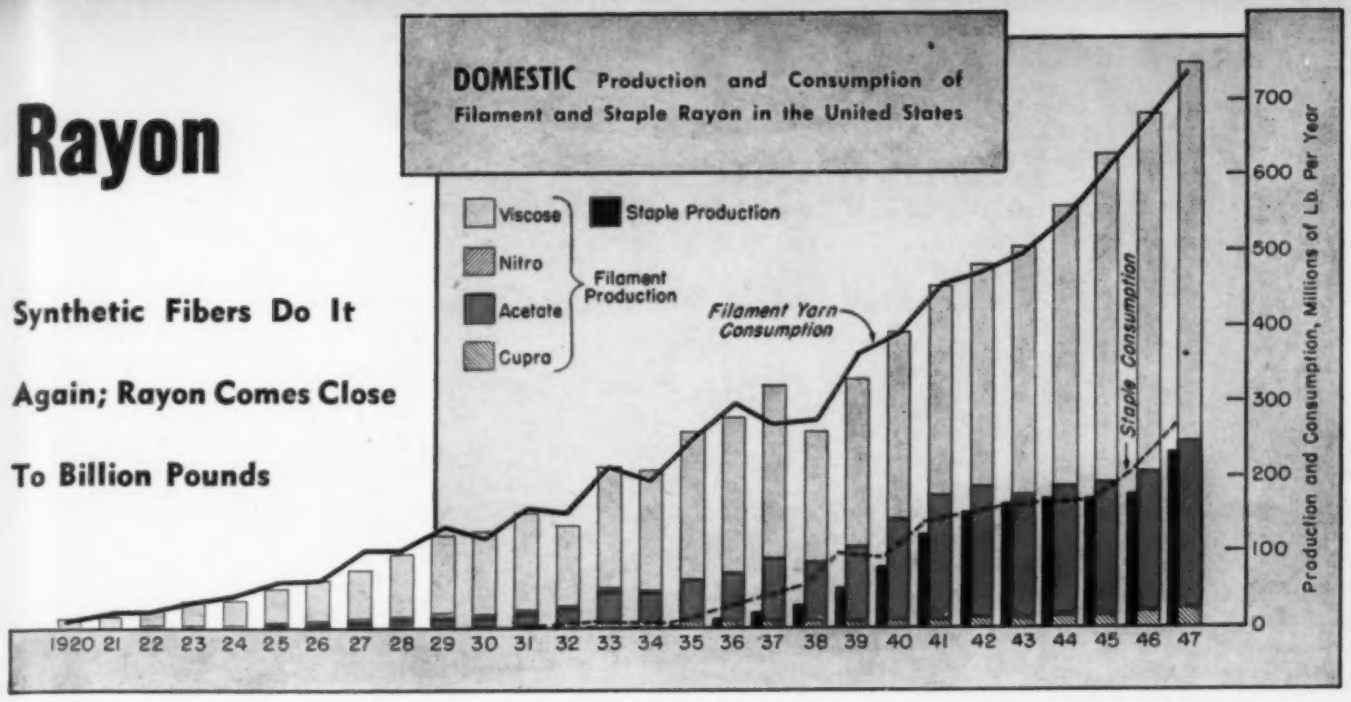
Two New Plastics

The Resinous Products & Chemical Co., introduced two new plastic products during the year. The first, Uformite F-240, is a butylated urea-formaldehyde. It is claimed to be useful in formulations where low ratios of urea-formaldehyde resin are required to speed up baking schedules. The second product, Duraplex ND-78, is a non-oxidizing phthalic alkyd resin. Its qualities include good alkali resistance, color retention, and compatability with urea and melamine based resins and the nitrocelluloses. Combined with urea-formaldehyde it forms vehicles particularly suited for white baking enamels. With nitrocellulose high quality lacquers are produced.

Plant expansion was not limited to polyvinyl chloride. Du Pont's new plant at Parkersburg, W. Va., is nearing completion. General Electric commenced production of silicone products at Waterford, N. Y., of laminated plastics at Coshocton, Ohio, and of phenolics at Anaheim, Calif. Bakelite facilities for all plastics and resins is being increased 50 to 60 percent. New units or plant expansions are underway at Ottawa, Ill.; South Charleston, W. Va.; Texas City, Tex.; Bound Brook, N. J.; Monterrey, Mexico; and Belleville, Ontario.

Rayon

Synthetic Fibers Do It Again; Rayon Comes Close To Billion Pounds



ACCORDING to the custom of the industry, rayon again broke all previous records, in 1947 bettering 1946 by about 14.5 percent. Since the industry's earliest days there have been only four years—1918, 1932, 1934 and 1938—when the performance of any year has not improved on that of the 12 months that preceded it. With a few minor exceptions the trend since 1928 has been a substantially straight line with an average increase of 13 percent a year. And this does not include the synthetic fibers based on materials other than cellulose and its esters, which themselves account for perhaps as much as 50,-60,000,000 lb. per year, or about 5 percent of rayon. Nor does it include the acetate and regenerated cellulose wrapping film production which now amounts to close to 150,000,000 lb. per year.

The record of rayon since its infancy is portrayed in the accompanying chart and tabulation which are based largely on data collected by the *Rayon Organon*, official statistics compiler of the industry. Unfortunately, as this account is written, final 1947 figures are not available and it is necessary to estimate on nine months' production totals and 11 months' domestic shipment figures as issued by the *Organon*. From these it appears that filament yarn amounted to about 745 million lb. in 1947, comprising 525 million of viscose plus cuprammonium, and 220 million of acetate yarns. Tire yarn, we believe, accounted for about 232 million lb. of the viscose total. Staple fiber, totalling about 232 million lb., consisted of 172 million of viscose and 60 million of acetate. The increase over 1946 is 10 percent for filament yarns, 32 percent for staple fiber, 11.7 percent for all viscose rayon, and 21.7 percent for all acetate rayon.

Rayon consumption also was up sharply. It appears that total domestic consumption was about 993 million lb., which included 731 million of filament yarns, 224 million of domestically produced staple fiber and 38 million of imported staple fiber. Filament yarn exports are estimated at about 17 million lb. Compared with 1946, consumption appears to have increased by 13.5 percent, with filament yarns up 9.8 and staple fiber up 25.9 percent. The estimated increase for yarn exports is 36 percent, and for staple imports, 15 percent. Tire yarn which is largely high-tenacity viscose, plus a minor percentage of nylon, apparently increased slightly less than 10 percent.

From studies of rayon capacity by *Rayon Organon* it is expected that the end of this year will see a total annual capacity of about 1,120 million lb., which is a 26 percent increase over the capacity at the start of 1947. By the end of 1948 the total is expected to be 1,175 million. Present total capacity is about 1,022 million lb. A breakdown of the increases through 1949 shows that viscose filament yarn will represent a considerably smaller percentage of the total than at the beginning of the three-year period, while viscose staple will almost hold its own percentagewise. The percentage for tire yarn will increase slightly, while there will be a considerable increase in

(*Continued on page 122*)

WORLDWIDE U.S. and World Production of Rayon

	FILAMENT YARNS			STAPLE FIBER	
Year	U.S. Production	U.S. Export Balance[1]	World Production	U.S. Production	World Production
1923	34,960	—3,029	102,990		
1925	51,050	—5,293	185,290		
1927	75,555	—14,633	295,095		
1929	121,400	—14,832	434,215	500	7,165
1931	150,880	—1,490	500,195	880	7,980
1933	213,500	176	665,000	2,100	27,920
1935	257,555	2,193	940,855	4,600	140,310
1937	320,995	525	1,203,890	20,245	628,100
1939	328,625	1,703	1,156,115	51,315	1,097,710
1940	390,070	1,410	1,181,180	81,100	1,288,235
1941	451,205	3,213	1,270,240	122,025	1,555,155
1942	479,330	5,600	1,196,170	153,285	1,455,250
1943	501,125	9,500	1,149,655	162,020	1,383,460
1944	555,215	16,300	1,030,655	168,740	1,036,035
1945	623,670	22,000	901,060	168,400	515,020
1946	677,540	14,500	1,102,655	176,400	569,000
1947	745,000[3]	17,000[3]	[2]	232,000[3]	[2]

Data from Rayon Organon except as indicated. All figures given in thousands of lb.
[1]Minus indicates net imports. [2]Data unavailable. [3]Chem. & Met. estimate.

Electrochemicals

For Chlorine and Fluorine, New Cells; For Platers, A New Horizon

IN THE electrochemical industries there have been various recent developments of interest and importance. The demand from electroplaters for methods that would reduce the labor required for polishing before and buffing after plating has led to the development of plating solutions and methods which "cover" surface roughness better and which buff easier in cases where the plate does not have full brightness as deposited.

Emphasis in protective and decorative plating is on rapid or high speed deposition and on bright plate. Methods for plating at greater speed than heretofore are available for silver, gold, bright nickel, copper, chromium, and zinc. New or improved bright plating methods are available for nickel, copper from both acid and alkaline solutions, and zinc from both acid and alkaline solutions. There is still a need for simple and improved methods of plating on aluminum, magnesium, and zinc and die castings of alloys of these metals.

Electropolishing

Full brightness is readily attained without mechanical effort by another new development in the metal finishing industry, electropolishing. There are commercial methods for application to metals requiring no additional finishing, for application to metals to be subsequently bright-plated, and for application to electrodeposited coatings. Electropolishing shows appreciable savings in finishing costs.

Electrodeposition of alloys is receiving extensive industrial attention. Being a cold process, the disadvantages of hot methods are absent. Metals immiscible in molten state can be alloyed in sound form. Alloy electroplates are amenable to the usual metallurgical practices for annealing, hardening, etc. Frequently, electrodeposited alloys can be made stronger or harder than cast alloys. Electrodeposited alloys of refractory metals such as tungsten, molybdenum, titanium, zirconium, and tantalum can be expected in the future. Cobalt-tungsten alloy plating methods have been developed. The alloy can be heat treated to effect hardening by characteristic precipitation effects. The applications for such chemically resistant, high-melting alloys are immediately available in high-temperature machines now under development.

There is an important and significant trend in the electroplating field toward what might be called "engineering plating." The electrodeposited metal overlay provides improved functional performance and engineering properties, wholly aside from and independent of protective and decorative applications. Chromium plating is in this category because of its wear resistance, low coefficient of friction, high melting point, and chemical inertness. Electrodeposition of alloy bearing liners is in large production.

Metal casting and stamping methods are being replaced by electroforming, which is the method of making a complete or essentially complete metal article by electrode deposition on a permanent or temporary form from which the electroform is removed. Advantages are found for maintaining inside dimensions within very close tolerance, elimination of multiple hand assembly operations, and use of metals having selected properties for service but not suitable for casting or cold or hot forming.

Electrowinning of manganese seems well assured and a method for chromium appears close at hand. This recovery method is receiving attention for producing other metals in pure form. It can be expected that electrowinning and electroforming will be combined in a process that starts with the ore and turns out an essentially completely formed metal article, without passing through an intermediate step or steps of smelting, refining, rolling or casting of the metal.

Dry cells and storage batteries have been the subject of intensive study. Improvements can be expected in the nature of small batteries having high energy capacity per unit of weight. The Ruben cell, an alkaline cell (U. S. Pat. 2,422,045 and 2,422,046) described in *The Electrochem. Soc.* Vol. 92 Preprint 6, is significant in that it has a small battery of high capacity for use in equipment where space and weight are at a premium. A truly "dry" cell, as manufactured, has been reported. It is stored in sealed cans with a desiccant and develops its electricity when immersed in salt water. (*The Electrochem. Soc.*, Vol. 90, Preprint 33.)

Two new developments are worth mentioning in electrolytic chlorine-caustic soda cells. In the fall Mathieson Alkali Works announced a new stationary mercury cell. The first commercial installation of these cells is in operation at the Arvida, Quebec, plant of the Aluminum Co. of Canada. Mathieson decided to license the use of this mercury cell process and it has been made available to several companies. For detailed description of the cell see *Chemical Engineering*, November 1947, pp. 108-112.

New Hooker Cell

A new larger Hooker cell, known as the Type S-3 Cell, having a rated capacity of 20,000 amp. has been developed by the Hooker Electrochemical Co. This cell greatly reduces the building space requirements and, in plants having a chlorine capacity of about 75 tons per day and larger, offers substantial savings in investment and operating costs as compared with the Type S cell. The first commercial installation of this type cell will be started early in 1948.

Most of the current work on fluorine and its derivatives is in the realm of research. Electrolytic cells have been developed by a number of manufacturers including Pennsylvania Salt Mfg. Co., Harshaw Chemical Co., General Chemical Co., E. I. du Pont de Nemours & Co., and Hooker Electrochemical Co. While elemental fluorine is available only from Pennsalt, a complete laboratory size fluorine cell unit is available from Harshaw for use in making fluorine.

A variety of fluorine compounds (both from fluorine and hydrofluoric acid) are available, some in commercial quantities and others only for experimental purposes. One important compound commercially available from General Chemical and Pennsalt is sulphur hexafluoride. This inert gas has a greater dielectric strength than any other known gas. For this reason it is a most promising gaseous insulating medium for high voltage applications.

Petroleum Refining

From Undreamed of Demand, a Production Nightmare; New Tricks Push Capacity to Limit

THE PETROLEUM refining industry concentrated all the resources of its technical ingenuity and those of equipment manufacturers, last year, on the problem of expanding the capacity of existing equipment to meet the unprecedented demand for petroleum products. The effort was notably successful and was probably the outstanding achievement in petroleum processing during 1947.

In the field of new design of equipment the introduction and successful operation of catalytic cracking units of small capacity dispelled a supposition of a few years ago that such units could not be built and would therefore be beyond the reach of the small refiner.

Some spectacular results were obtained in the effort to reduce the loss of production and money which occurs every day that a refining unit is idle because of need for inspection and repairs. Normally, catalytic cracking units present formidable problems of this kind. Refiners, however, found out that the rest periods of these monsters can be materially shortened. Last summer one of the Standard Oil Co. of New Jersey refineries on the East Coast succeeded, by a tight coordination of effort, in overhauling a fluid catalytic cracking unit in the record time of two weeks. The usual idle period had been three weeks. The reduction in time made possible the production of about six million gallons of gasoline and heating oil which otherwise would not have been manufactured.

The principle of "coordinated turnaround" has been found applicable to all refining units. Last year in the Standard Oil refinery at Baton Rouge a phenol plant was taken out of service and restored to operation in three weeks, whereas the normal idle period had been from four to six weeks. This refinery has found that under the coordinated turnaround system time has been saved in every instance where the system has been applied.

Material increases in refining capacity also resulted from redesign of existing equipment to remove bottlenecks. One large Gulf Coast refinery devoted considerable study to improving the throughput capacity of its catalytic cracking unit and increased the capacity by 7,000 bbl. per day by improving the heat recovery system and the stripping of the catalyst, in addition to better planning of work and mechanical maintenance. By altering two fluid cracking units at its Baton Rouge refinery, Standard Oil Co. of New Jersey succeeded in increasing their capacity by 8,000 bbl. per day each.

Restored Capacity

The restoration of idle capacity to use was another factor in enabling the refining industry to meet the heavy demands for fuels and lubricants last year. Humble Oil and Refining Co. at Baytown was able to obtain an appreciable increase in production by putting back into operation nine thermal cracking units, idle since the war ended, to make up the difference between current demands for gasoline and the quantities which the catalytic cracking units could produce. At Coffeyville, Kan., Cooperative Refinery Association was able in three weeks to convert a butane isomerization unit, used during the war to manufacture aviation gasoline, to the production of motor gasoline at a cost of only about $20,000.

An important development of the year was the introduction of small, compact catalytic cracking units having gas oil charge capacities as low as 3,000 to 5,000 bbl. per day.

The list of small crackers completed or started included a Thermofor unit of Lion Oil Co. at El Dorado, Ark.; another Thermofor unit in the refinery of Leonard Refineries at Alma, Mich.; and three fluid-type units, one each in the refineries of Ohio Oil Co., Robinson, Ill., The Texas Co., Casper, Wyo., and Aurora Gasoline Co., Detroit, Mich. The designs of these units contain numerous significant departures from those used during the war and are intended to reduce consumption of steel, cut investment costs and simplify operation. The use of a single elevator to carry both spent and regenerated catalyst is a feature of the Thermofor units. In the units of the fluid catalyst type important changes have been made in the heights and relative positions of the regenerators and reactors. Reductions in requirements for structural steel and piping have come about as the result of such changes.

Means to reduce costs of manufacturing engrossed all refiners during the year. Renewed interest was aroused in the several types of extractive sweetening processes as alternatives to the older doctor sweetening of gasolines and other light fractions. Extractive sweetening, by reducing the total sulphur content of such products rather than increasing it, as the doctor method does, has the advantage of reducing tetraethyl lead consumption in gasoline manufacture, and in some instances reduces treating costs. Also, refiners were investigating methods to reduce the amount of sulphur and salt in the less desirable types of crude which many were forced to process.

Continuation of heavy capital expenditures authorized during 1947 and further advances in refining technology is the outlook for this year. It was estimated last June on the basis of a survey of the larger companies that the projected new capital investment for refining would reach $1 billion during 1947-1948. The industry has about reached the limits of its ability to push more oil through old equipment and will install much new equipment this year to meet the expected continuation of demand for petroleum products which was undreamed of at the close of the war.

Amount for Research

No reliable estimate of the amount of money to be spent in reasearch and development in 1948 is at hand. However, this will easily run to many millions. Refiners expect numerous improvements will be made in processes which hurriedly matured during the war. Much attention will be devoted to jet fuels. Late last year The Texas Co. was nearing completion at Beacon, N. Y., of a large laboratory for the investigation of fuels of this type. Improved methods of using petroleum products, and development of new uses, will continue to receive attention. At Wood River, Ill., last fall Shell Oil Co. established a laboratory devoted entirely to the examination of asphalt and investigation of its current and potential uses.

Alcohol and Solvents

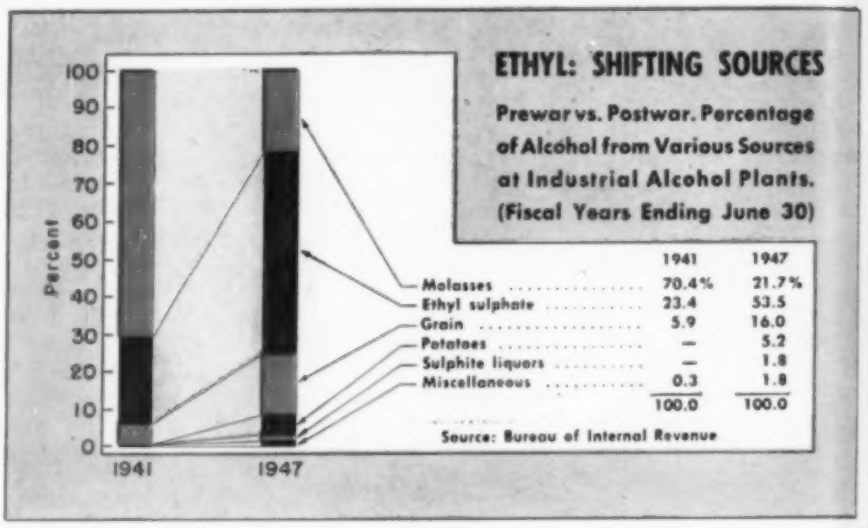
Molasses Mix-up Snarls Fermenters, Output Slumps; Methanol Labors, Delivers a Record But It's Not Enough

HIGHLIGHTS in the alcohol and solvent business last year were the preponderance of consumer demand over supply and the rising trend in sales values. The position of ethyl alcohol was somewhat clarified around the middle of January by establishment of a free market for molasses with the Reconstruction Finance Corp., which had purchased the Cuban output, becoming the sales agency. It was announced at that time that the quantity of molasses available would be sufficient to produce approximately 90 million gallons of alcohol. In addition RFC held about 10 million gallons of Cuban and domestic alcohol, thus making a total prospective supply for the year of 100 million gallons. It also is believed the Cubans would contribute additional molasses during the year.

First sale of molasses under RFC was made at 30c. a gallon against a delivered cost of 17c. The price then dropped to 22c. a gallon but a rising trend set in later in the year with latest sales again around the 30c. level. Top price was 34c. on a sale made in May.

As some molasses was used for production of chemicals, including normal butyl alcohol and acetone, total fermentation alcohol from new production and stocks was about 90 million gallons. Synthetic producers contributed 70 million gallons so total supply for the year was approximately 160 million gallons. All synthetic production was used to produce acetic anhydride and other chemicals so that other industrial users including anti-freeze, were dependent upon the supply of the fermentation product.

Prices for fermentation alcohol followed the pattern reported for molasses. In March the sales figure was advanced to 98c. a gallon. In May, general anticipation of a business recession led to a drop in consuming interest which was reflected in the market for molasses and two producers of alcohol reduced prices by 9c. a gallon. One producer made commitments for six months at the reduced level. In the early fall, however, buyers became active and with threats of an anti-freeze shortage, alcohol prices moved back to the figure maintained prior to the 9c. cut. The year closed with virtually no inventories either of molasses or alcohol.



Methanol

In the early part of the year, companies which had taken over government plants which might be converted for methanol production, were under pressure to turn out ammonia for the fertilizer trade. Other facilities, however, were pushed to near-capacity rates in an attempt to satisfy the unusually high requirements for formaldehyde, anti-freeze, and other products. The result was the establishment of an all-time high production record of about 81 million gallons. This high output was achieved in spite of the fact that two producers were somewhat hampered because of the coal strike. Furthermore, there was an explosion at one producing plant which forced a cut back of that plant's contract accounts by about 30 percent.

It had been anticipated that 1947 would see additional methanol capacity come into operation but several crippling strikes and inability to get equipment resulted in a series of delays and most of the new facilities expected to be installed will not materialize until the second quarter of this year.

When it became apparent that an anti-freeze shortage must be faced, it was expected that methanol would take over most of that market. Actually not more than 30 million gallons of methanol went into anti-freeze and it was necessary to fill in with high priced ethyl alcohol. Producers of natural methanol operated on a lessened scale. Some plants ceased operations and those remaining in the field found difficulty in filling requirements for denaturing and for anti-freeze.

Isopropyl Alcohol and Acetone

Because of the shortage of ethyl and methyl alcohols, many industrial consumers who formerly used these alcohols, readjusted their processes to admit of the use of isopropyl. As a result demand for isopropyl was far in excess of the almost 110 million gallons produced. As about 70 percent of production is converted into acetone and 10 percent into anti-freeze, only about 20 percent is left for all other consumers and this fell far short of meeting needs. During the year a new producer entered the field but the year closed with all producers running at capacity without inventory and with a backlog of orders.

Various conditions were found at different times during the year in the market for acetone. Production was

Total

Millions of Proof Gal.

	1940	1941	1942	1943	1944	1945	1946	1947
Production*	244	299	425	448	637	683	329	249
Withdrawn for denaturing†	223	274	385	408	973	971	393	335
Withdrawn taxpaid	24	28	25	6	6	28	47	47
Stocks, June 30	22	10	29	210	125	141	111	27

Denatured

Wine Gal.

Production	1947	1946
Completely denatured	36,395,715	26,144,437
Specially denatured	147,348,371	186,657,673
Total	183,744,086	212,802,110
Withdrawals		
Completely denatured	36,324,125	27,118,835
Specially denatured	154,927,752	197,554,311
Total	191,251,877	224,673,146
Losses	147,446	285,815
Stocks, June 30		
Completely denatured	102,261	45,595
Specially denatured	1,878,777	8,919,656
Total	1,981,038	8,965,251

*Production at industrial alcohol plants. †Represents products withdrawn as alcohol whether originally produced as alcohol, spirits, or unfinished spirits.

ETHYL: BALANCE SHEET

Supply and Distribution of All Ethyl Alcohol and of That Portion Which Is Denatured. (For Fiscal Years Ended on June 30)

in the neighborhood of 350 million pounds but the rate of monthly output was not uniform as operations of two large producers were temporarily slowed by a fire and by strikes. The ensuing drop in production led to periods of extreme shortages. Later a large textile plant was beset by labor difficulties and this released a considerable amount of acetone which put an end to the shortages and for a brief period there actually was a surplus of acetone on the market.

Producers of fermentation acetone were at a disadvantage because of the scarcity of raw materials and the high prices they had to pay to get supplies. As an offset to higher production costs, some fermentation acetone was disposed of in export channels where it was possible to obtain premium prices.

Higher Alcohols and Acetates

Under normal conditions the greater part of normal butyl alcohol is produced by fermenters but due to difficulty in getting either molasses or grain, fermenters did not run to capacity. Hence last year's output, estimated at 21 million gallons, was neither adequate for requirements nor up to existing plant capacities. As a matter of fact, a substantial amount of total production was supplied by a synthetic producer who increased his production during the year and assumed the role of a major producer.

Due to the high prices of raw materials, the price for fermenters butyl alcohol at no time last year was below 25c. and reached as high as 32c. a pound as compared with 14c. which was the price of the synthetic product for the greater part of the year.

As was the case in the preceding year, scarcity and high prices for butyl alcohol and acetate opened a wider market for secondary butyl acetate and methyl isobutyl ketone but production of these two products could not be raised enough to equal the demand for them.

Methyl Ethyl Ketone

During last year, as in previous years, methyl ethyl ketone producers operated to capacity and all producers ended the year without inventory. With the increase of vinyl in dewaxing plants, demands for ketone were increased. Many cellulose coating producers endeavored to obtain large amounts of ketone as the price was considerably below either synthetic or fermentation ethyl acetate.

For 1948, the pattern of the alcohol and solvent business will undoubtedly reflect the trend of national economy, and for the first quarter, and possibly the first half of the year, supply and demand for alcohols and solvents will be out of line, with the result there will possibly be higher prices. However, during the latter part of the second quarter the new production of methanol will allow methanol producers almost to double their existing production.

A new synthetic ethyl alcohol producer will come into production during the second quarter and this production, unlike that of the two present synthetic producers, will be sold entirely to the consumer so that there will be at least an additional 8 to 12 million gallons of ethyl alcohol available during the second half of the year.

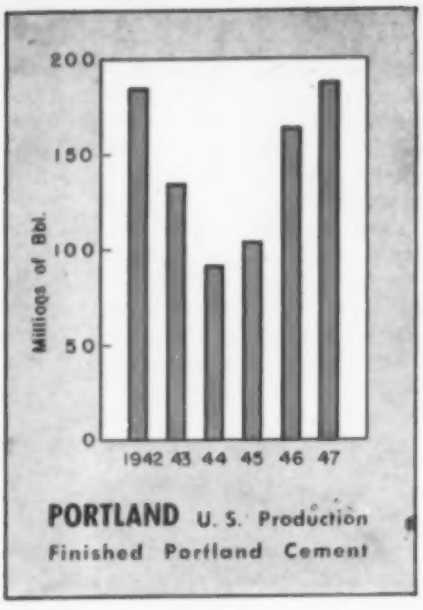
The first quarter for ethyl alcohol will be very tight as there is only a small inventory of molasses and no alcohol stockpile. The new molasses crop will start moving in February and up to the present time there is no announcement of any provision on the part of government to purchase or sustain the molasses market. It is understood, however, that the British government has already made a substantial purchase of molasses from the Cuban government which will reduce the available supply.

If the present grain market continues in short supply and is high priced, undoubtedly a large part of the molasses crop will be consumed as cattle feed and on the surface molasses would appear to be in short supply. However, the Caribbean sugar crop is the largest in many years and undoubtedly the Cubans will find difficulty in selling it as sugar. If the sugar market does back up, based on previous patterns, they will undoubtedly produce invert molasses or convert it to alcohol which will be shipped to Europe, or the invert molasses shipped to the United States. In either case, with supports withdrawn, fermentation alcohol should be in greater supply at considerably lower prices.

With new glycol facilities coming in, and greater supplies of methyl, ethyl, and isopropyl, anti-freeze demands will be more normal and industrial demands better satisfied.

With greater supplies of molasses, normal butyl alcohol will not be as difficult to obtain as it was in 1946 and 1947, and a shortage of high boilers may be somewhat alleviated by the new synthetic amyl which will be on the market, which will tend to ease the high boiler shortage.

Another factor which may contribute to easing of the alcohol and solvent market will be that the production of protective coatings cannot expand as fast as they would like, due to the shortage of plasticizers and certain pigments and resins.



Cement, Ceramics

Production Good But Not Gaudy; Technology Wins Top Billing, Features Fluidization

IN SPITE of a strike estimated by the U. S. Bureau of Mines to have cost some 4 million bbl. to 33 plants in northeastern United States, the portland cement industry produced slightly more finished cement in 1947 than in the biggest previous year of 1942. Production was about 188 million bbl., estimated at better than 90 percent of the capacity of the industry.

Considerable new plant construction is now going on in several states, as well as plant rehabilitation for higher efficiency. High fuel costs are forcing a trend toward longer kilns. The movement toward the wet process is continuing, and a need for closer control of composition and particle size is being noted. The result is that more attention is now paid to closed-circuit grinding and to blending. The urge for higher fuel economy is causing most new plants to employ some form of heat recuperating device on the kilns, while a trend toward improved working conditions is resulting in increased application for dust collecting equipment.

Closely related to cement, the lime industry is also showing progress. Our December 1947 issue (pp. 112-115) described the 100 ton per day lime calciner to be built by the Dorr Co. at Adams, Mass., for New England Lime Co., which will employ the fluidizing principle for the first time in a commercial scale lime calcining operation. Columbia Chemicals Division of Pittsburgh Plate Glass Co. demonstrated the importance of a conveniently situated limestone supply for alkali manufacture during 1947 when it opened a new mine at Barberton, Ohio, from which the stone is being taken out at a depth of ½ mile, believed to be deeper than any other lime mine in the world.

Ceramics and Glass

Both the ceramic and glass industries enjoyed good years in 1947, although for both there were problems of labor, transport and raw material supply. The various divisions of the ceramic industry reported varying experiences, heavy clay products being about on a par with 1946, except for sewer pipe, which was well ahead. Both whitewares and dinnerware were above the 1946 level, with demand in excess of capacity, but considerable plant expansion was under way or projected. The glass industry as a whole was well over the earlier year with containers about on a par, glassware somewhat below, and flat glass considerably higher. Special glass products such as textile fibers and fibrous insulation expanded rapidly.

Technical advances were scored in all branches of ceramics. New bodies and progress in forming methods were emphasized in electrical porcelain. Dry pressing and the development of organic binders and lubricants proved important in the whitewares field. In table ware, infra-red driving contributed startling decreases in drying time, while there was further development in automatic machinery, particularly for jiggering.

The soda ash shortage was one of the high points in the glass industry's year, with some success and considerable research in finding soda ash substitutes. The industry has been giving attention to electric melting which is still too expensive. Much basic research is being conducted and new glass forming machinery is being introduced. Interest is growing in plastic-reinforced glass fibers, while super-fine fibers are offering possibilities for glass fabrics in the apparel field. Sheet glass is expecting a boom from the growing use of double- and triple-glazed windows.

RAYON

(Continued from page 117)

percentage for both acetate filaments and acetate staple. Some of the increase is coming from refurbishing of existing plants. At present American Enka is building a viscose plant at Lowland, Tenn., Celanese Corp. is working on an acetate plant at Rock Hill, S. C., and Du Pont is constructing a new nylon plant at Chattanooga, Tenn., bringing the nylon plant total to three. A newcomer in the fiber field, Glass Fibers, Inc., has recently completed a plant at Waterville, Ohio.

Reviewing both economic and technical developments of the year, demand was constantly ahead of supply, and some viscose plant schedules were cut back because of the caustic soda shortage. The industry was plagued by rises in raw material costs which forced rayon producers to the third small price rise in the last six years—the first having been late in 1946. Other difficulties arose from transportation troubles, strikes and slow equipment deliveries.

Major machinery improvements have brought about higher quality and greater spinning speeds, while new interest in continuous spinning is evident from new continuous machines brought out both here and abroad.

Among the more recent developments in the synthetic fibers, it should be mentioned that nylon is now going into industrial fabrics, while nylon staple is finding increasing use, either alone or blended with other fibers such as wool and cotton. High-tenacity viscose is not only going increasingly into tire fabrics and cord, but also into mechanical rubber goods.

Non-woven fabrics, consisting of unspun fibers bonded in various ways, are now appearing in substantial volume, primarily as disposable fabrics. New experimental fibers, together with modifications of the older ones, are yielding products of extremely high strength, or with improved durability. New fibers have not yet become important commercial factors, but many plastics are fiber possibilities.

Pulp and Paper

South Gets Second Wind;

Peroxide Hits Gallop, Takes Groundwood in Stride

AN ITEM of almost daily news is the announcement of an expansion of one of the southern pulp and paper mills, of an entirely new mill south of the Mason and Dixon Line or of the construction of a plant for converting the pulp and paper into bags, boxes and other products. These announcements taken together mean the resumption of that tremendous development in the industry that got under way ten or fifteen years ago but which was interrupted by the war.

The present building program is rapidly approaching that of prewar years and may result in doubling the capacity of the Southern mills. To mention only a few of the projects, International Paper Co. has authorized the expenditure of $47,000,000 for expansion of its mills, thus increasing capacity by 1,175 tons of kraft paper per day. Ecusta Paper Corp. at Ecusta, N. C., is spending several million dollars on expansion and improvements to its cigarette paper mill.

Increased Production

Gulf States Paper Corp. at Tuscaloosa, Ala., is increasing its production to a figure between 300 and 350 tons of kraft paper per day. Champion Paper Corp. is reported to be planning to build a mill on the Neches River in East Texas. Work on the South's second newsprint mill is about to begin. The Coosa River Newsprint Co.'s mill at Childersburg, Ala., will make groundwood and sulphate pulps and newsprint paper. It will be operated by Kimberly Clark. Bemis Bro. Bag Co.'s new plant at Jacksonville, Fla., will produce bags for citrus fruit. Kimberly Clark is spending $6,000,000 at Memphis to make creped wadding for Kleenex, Kotex and other products. Mead Corp.'s subsidiary, Macon Kraft Corp. at Macon, Ga., is constructing a pulp and container board mill.

Plants for converting the sulphate pulp and paper into containers and other products are appearing near the centers of pulp and paper production. It is to be expected that the South will have a large share of these plants.

In the early days of the newsprint mill at Lufkin, Tex., many predicted its early failure. Since then it has been doubled and redoubled. Ground was broken for the second newsprint mill and there are rumors of a third for the South.

Elsewhere mills are also active. The sulphite effluent from the Gatineau mill of Canadian International Paper Co. near Ottawa will be converted into alcohol in a $2,500,000 plant to be operated by Commercial Alcohols Ltd. of Montreal. This plant will produce two million imperial gallons of alcohol per year.

It has been demonstrated that most hardwoods can be pulped satisfactorily by either the sulphate or soda processes. This will probably double the potential supply of pulpwood in the country.

The sodium peroxide process developed in the laboratories of the E. I. du Pont de Nemours & Co. for the bleaching of groundwood or mixtures of groundwood and sulphite pulp has now been accepted by the industry. Several mills are installing the process.

When the bleach plant of St. Regis Paper Co. commenced operating it was the first time in history that a pulp and paper mill successfully bleached a high consistency mixture of groundwood and sulphite by a continuous sodium peroxide process. Use of sodium peroxide as a bleaching and pulping agent is a very important development. Its importance has been compared to the introduction of the sulphite and sulphate pulping processes. It has broad applications.

Sodium peroxide too is the basis for one of the recently developed de-inking processes. It was developed jointly by the Newton Falls Paper Mill and du Pont. Conventional recovery processes which have been giving satisfactory performance with waste papers essentially free from groundwood, have demonstrated serious shortcomings when applied to waste papers with a substantial groundwood content. Consequently, as increased quantities of groundwood entered into paper production, new problems arose in connection with the de-inking and bleaching operations in recovery processes. The sodium peroxide process is the solution to the problem.

Some bleaching and brightening are obtained during the de-inking operation. Furthermore, the peroxide persists to the end of the cooking step in concentrations sufficient to inhibit the color reversion that groundwood undergoes when subject to a hot alkaline treatment. In this respect the functioning of peroxide differs from its bleaching action on groundwood-sulphite mixture. For a description of the process see *Chemical Engineering*, pp. 99-102, January 1948.

It is reported that a new process for pulp making will be used in the new mill of Celanese Corp. of America's subsidiary, the Port Edward Cellulose Co. The $15,000,000 plant for making both sulphate and sulphite pulps is under construction on Watson Island near Prince Rupert, B. C.

Magnesium Oxide Process

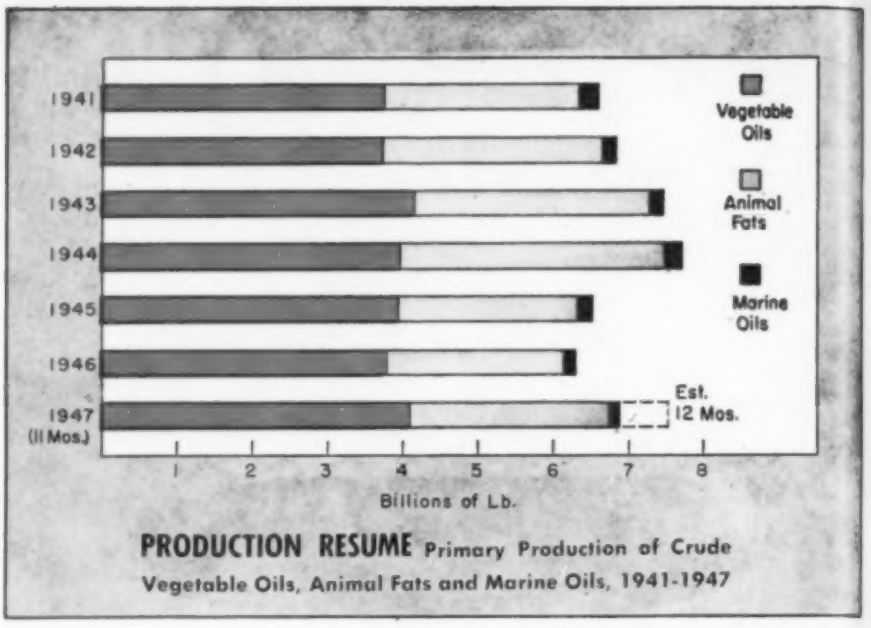
It is expected that in March the magnesium oxide process will be in commercial operation in the West Coast mill of Weyerhaeuser Timber Co. In this process the cooking liquor is magnesium sulphite. The quality of sulphite pulp produced by the magnesium base method is said to be superior to calcium base pulp.

The ammonia process for pulping wood is now used commercially by the Shelton, Wash., mill at Rayonier. The Eastern Corp. at Bangor, Maine, and other companies are experimenting with the ammonia process. The pulp produced by the ammonia base is said to be superior in physical and chemical characteristics to either the calcium or magnesium base methods. Among the advantages of ammonia base are (1) exact control of cooking acid composition, (2) more uniformly cooked pulp, (3) higher pulp yield, (4) lower ash content of pulp, and (5) elimination of evaporator and heat exchanger scaling.

Several mills are now replacing lime with sodium sulphite in straw pulp cooking. In England at least one mill is using a continuous process for cooking straw.

And mention should be made of one more development. Paper machine coating at high speeds is now being done by the micro-jet coater. This method has created a new type of printing paper. It is half-way between coated paper and machine made paper. This method also has greatly increased use of groundwood as a base for printing papers. For description and photographs of this process see *Chemical Engineering*, January 1948, pp. 99-102.

Oils and Fats



PRODUCTION RESUME Primary Production of Crude Vegetable Oils, Animal Fats and Marine Oils, 1941-1947

Solvent Extraction Cuts New Capers; Oilseed Crop Jumps Million Tons, Consumers Breathe Easier

INCREASED domestic production and imports of fats and oils gave process industries a little more flexibility than they have had since the war began. Domestic oilseed crops produced in 1947 totaled approximately 12.4 million tons compared with 11.2 million in 1946 and 10.2 million for the preceding ten-year average. Technical advances of importance are also credited to the year.

Solvent Processes

Successful pilot-plant operation of a solvent process, which separates cottonseed oil and meal and also removes the cottonseed pigment glands as a third principal product, marked one of the outstanding advances. Pigment glands represent 3 to 4 percent of the weight of cottonseed. They are separated from the flaked kernels of cottonseed by adjusting the specific gravity of the solvent mixture to a point between that of the pigment glands and that of the meal. The meal sinks in the solvent and the pigment glands float. The result is a better-quality oil and a pigment-free meal which has shown promising initial results in feeding tests.

For many years, limitations on the use of cottonseed meal in feed have been attributed to the presence of gossypol, one of the major pigments in cottonseed. Recent experiments have shown that gossypol is not the principal factor in giving poor nutritive results with cottonseed meal. Research on this process, which is continuing at the Southern Regional Research Laboratory, has shown that at least related 11 pigments occur in cottonseed.

Commercial-scale solvent extraction of cottonseed is also an accomplishment of the year. At least two plants are known to be operating, each with a capacity of 200 tons of cottonseed per day. Conventional processing is used, however, rather than the new Southern Lab process described above.

Pilot-plant production of peanut oil and meal by solvent extraction methods has also been announced by the Southern Lab. Commercial hexane has been used as the principal solvent. The advantage claimed for this method is the production of a better meal for industrial uses. Peanut protein fibers have shown interesting properties when made with the solvent meal. The solvent-recovered peanut protein has also been found satisfactory for certain paper-coating operations and for use in cold-water paints.

Refining of fats and oils by a solvent technique using propane is known as the Solexol process. Announcement of this M. W. Kellogg Co. development was first made late in 1946. A number of plant installations were undertaken during 1947, including a tallow fractionating plant for Lever Brothers at Baltimore, and a multiple unit for Swift & Co. at Hammond, Ind.

The installation at Hammond is in three units, one of which is designed primarily for decolorizing fats and fatty acids for soap, although it may also operate on crude linseed or soybean oils. Another unit, a destearinizing plant, will separate glycerides and fatty acids into high-quality stearine and a clear oil of low pour point. Stearine will be precipitated by chilling, using the solvent itself as refrigerant. It can then be separated by special continuous rotary filters. The third unit is a pilot plant for developing new processes, or for commercial production of high-potency vitamin concentrates.

Fat bleaching with chlorine dioxide is now in commercial operation. At the New Year about ten generators were being installed in rendering plants in New York and New England.

Products

Increased production of chemicals derived from fats and oils by processes of Armour & Co. will soon be achieved. Expanded facilities at a new location will be in partial operation early this year and construction should be completed by the end of 1948. This represents another step forward in the program which Armour began about ten years ago. Prominent among the first products from fats and oils were new raw materials for protective coatings. Later the pure fatty acids have been used as raw

materials to produce high molecular weight aliphatic nitriles, amines, and amides. Other fat derivative products contemplated include quaternary ammonium salts, ketones, and waxes.

Developments in the field of chemical utilization of fats and oils as raw materials include further advances at the Eastern Regional Lab. It has been found, for example, that esters made from oleic acid can be polymerized with vinyl acetate, achieving a potentially useful compound which chemically combines a long-chain fatty molecule in the polymer for plasticizing or modifying certain resins.

First technical publicity on continuous saponification processes was released during 1947.

Raw Materials

Research at the Northern Regional Lab has shown that, contrary to common belief, no oil is lost from soybeans during storage.

Color of cottonseed products can be controlled to a certain extent by adjusting conditions of storage and processing. Low-temperature storage of seed, for example, has been found preferable to crushing the seed and storing crude oil if light colored products are desired. Addition of a small amount of moisture to fresh cottonseed when crushing it has also been found helpful.

Foreshadowed as a future development is research on oil content of hybrid corn. It has been pointed out that a higher dollar return is received from the oil than from any other constituent of corn. Strains of hybrid corn are being sought which maintain other desired qualities, and also show higher than average oil content. Although corn oil is a small factor at present in total supply of fats and oils, a significant increase in the oil content of a crop as large as the domestic corn crop could make it a much more important factor in relatively few years.

Statistics

Production of approximately two billion pounds of tallow and grease in 1947 set a new record.

Cottonseed crushings, on the other hand, were the lowest on record since 1922, according to the Census Bureau. Only 3.1 million tons were crushed during the season ending July 31, compared with 3.3 the previous season and 3.0 for the 1922 season. The average crush for the past ten seasons was 4.2 million tons. The record low crushings for the past two seasons reflect the correspondingly small cotton crops of 1945-46.

Official reports of cottonseed production in the 1947 crop will follow final ginnings for the season. Expected production, on the basis of the past five years' average ratio of lint to seed, would approach 4,750 thousand tons, compared with 3,511 thousand in 1946 and a 10 year average of 5,143 thousand.

Cottonseed Products in 1946-47
(1946 crop)

	Tons
Seed produced	3,511,000
Seed crushed	3,090,000
Crude oil	487,000
Cake and meal	1,363,000
Hulls	727,000
Linters (bales)	992,000

Facts for Industry: M17-4-07.

During the 12 month period ending Sept. 30, 1947, processors used a record 170 million bushels of soybeans for oil, compared with 160 million bushels in the preceding 12 months and 153 million bushels in the season ending 1945. Supplies of soybeans for 1948 crushing, however, will be the smallest in the past six years, as a result of an estimated 10 percent drop in the 1947 crop and smaller than average carry-over stocks. Although the 1947 crushing season set a new record, the urgent demand for oil kept prices high, averaging 18 percent above 1946 prices and more than double the 10 year level. Soybeans were supported by Congressional mandate at not less than 90 percent of the "comparable price." This level officially was $2.04 per bu. last year; 90 percent of the comparable price in December was calculated to be $2.12 per bu. Support at about this level is required through 1948, and will probably apply to the entire 1948 crop, although no official announcement had been issued up to the time when this review was made.

Peanut oil production in the year ending Aug. 31, 1947, was second only to the 1941 record of 174 million pounds. Crude oil produced in 1947 was reported at 139 million pounds. Late in November the Commodity Credit Corporation held approximately 66 thousand tons of peanuts, equivalent to about 6 percent of the record 1947 production, as a result of the mandatory price support program. Increased export demand for peanuts made it possible to suspend the marketing quotes for the 1948 crop.

Coconut oil availability during 1947 was high, based on an increase of about 20 percent over 700 thousand tons of copra produced in the Philippines in 1946. The 1934-38 average production of Philippine copra was only 654 thousand tons. The 1947 allocation by IEFC to the United States was equivalent to over 680 million pounds of coconut oil. This compared with an average of 550 million pounds consumed annually in the U. S. in the five years 1935-39.

Flaxseed production in the United States in 1947 was approximately 40 million bushels, the third largest crop on record. This compares with a 23 million bushel crop in 1946 and a 25 million bushel average crop. This quantity of domestic production was a fortunate offset to the Argentine crop, estimated to be about 40 million bushels also, down about 40 percent from the 1931-40 average of 67 million bushels. Difficulty in purchasing Argentine flaxseed, combined with the small crop there in 1947 and continuing strong demand in the U. S., has resulted in announcing a $6 per bu. support price again for U. S. flaxseed grown in 1948. The acreage goal is 4.3 million acres, the same as this year's planted acreage.

Domestic tung oil production in 1947 is estimated to have been about 12.7 million pounds. This compares with 11.1 million pounds produced in 1946. This years' production is expected to show another increase, to about 14 million pounds.

Fish oil production in 1947 was down about 15 percent below 1946. Part of this was due to a very low catch of pilchard, and part was due to low oil content of the menhaden.

International Barter

During 1947 an arrangement was announced which permitted exchange of U. S. produced soybean oil for surplus olive oil available in Mediterranean countries. This was on a pound-for-pound basis, permitting the olive oil producing countries to improve their dollar exchange for the purchase of other American products. February 1948 was the last month for which the trading offer was intended to be open. Olive oil is expected to be under allocation by IEFC this year, so the exchange arrangement will probably not be renewed. Approximately 3 million pounds of each oil was so swapped during 1947.

A similar arrangement resulted in the exchange of approximately 65 million pounds of lard to Belgium for a like quantity of palm oil.

Department of Agriculture purchases of fats and oils in 1947, for foreign relief and Military Government area shipments, amounted to about 130 million pounds.

Naval Stores

Wood Rosin Passes Peak; Pacing Industry to Record

IN THE first half of the 1947-48 naval stores year, production of turpentine showed an appreciable gain over the total produced in the corresponding period of the preceding year. While both gum and wood turpentine shared in the growth, the rate of increase was greater in the case of the wood product. Export trade gained but slightly and domestic consumers failed to increase their requirements to a point where they could absorb the larger production, hence more of the material was carried to inventory. Wood turpentine sales were much in line with those of the preceding year but gum turpentine lost ground largely because of the price advantage carried by wood turpentine and because of growing competition from low-priced mineral solvents.

Rosin has been finding a better market at home and abroad but again it is the wood branch which is forging ahead. In the first six months of the current crop year, the output of gum rosin is reported at 526,246 drums as against 573,322 drums for wood rosin. While this difference is not large it is significant inasmuch as production of gum rosin turns downward in the closing months of the crop year while operations at wood plants are independent of seasonal influences. Furthermore, facilities for producing wood rosin are being increased and it is estimated that total outturn for the 1947-48 season will approximate 1,200,000 drums as compared with about 870,000 drums of gum rosin.

In the latter part of last year the Bureau of Agricultural and Industrial Chemistry announced it was conducting research intended to lead to pilot plant production of chemical derivatives from pine gum or gum turpentine and rosin.

The Bureau of Agricultural Economics, which is the reporting agency for naval stores statistics, includes a breakdown of industrial usage and shows that in the first half of the present season, turpentine was used to a larger extent in chemicals and pharmaceuticals as well as in ester gum and synthetic resins. In other industries, however, a declining trend is noted. Use of rosin made its best showing in the case of chemicals and pharmaceuticals, linoleum, paper and paper size, and soap. It lost ground, however, in the fields of ester gum and synthetic resins, adhesives and plastics, foundries, insecticides and disinfectants, paint and varnish.

Average prices in the Savannah market for the 1946-47 season place gum turpentine at the record level of $1.0805 a gallon which compares with 30.03c. for 1940-41, the last prewar season. The average for all grades of gum rosin also represented a new price record, the figure being $7.65 per 100 lb. and comparing with the 1940-41 average of $1.98. In the present crop year prices have fallen from the former peaks and apparently the averages for the entire fiscal period will reverse the trend which prevailed over the preceding six years.

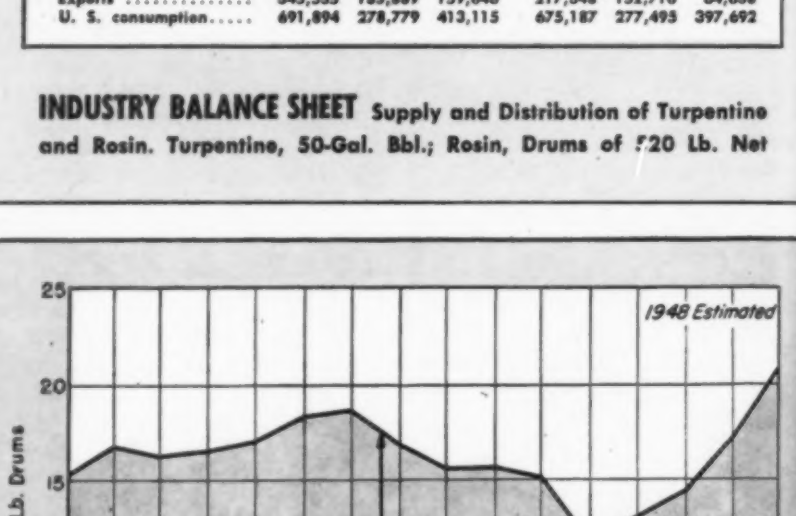
Turpentine

	April-September, 1947			April-September, 1946		
	Total	Gum	Wood	Total	Gum	Wood
Carryover, April 1	98,205	34,433	63,772	100,749	58,088	42,661
Production	365,778	197,090	168,688	313,410	179,255	134,155
Imports	7,277	7,277	—	10,081	10,081	—
Available supply	471,260	238,800	232,460	424,240	247,424	176,816
Carryover, Sept. 30	194,111	98,504	95,607	90,167	48,411	41,756
Apparent consumption	277,149	140,296	136,853	334,073	199,013	135,060
Exports	46,430	30,765	15,665	45,288	32,216	13,072
U. S. consumption	230,719	109,531	121,188	288,785	166,797	121,988

Rosin

Carryover, April 1	222,701	127,284	95,417	388,682	237,504	151,178
Production	1,099,568	526,246	573,322	906,366	469,195	437,171
Imports	—	—	—	—	—	—
Available supply	1,322,269	653,530	668,739	1,295,048	706,699	588,349
Carryover, Sept. 30	284,840	188,862	95,978	402,513	276,494	126,019
Apparent consumption	1,037,429	464,668	572,761	892,535	430,205	462,330
Exports	345,535	185,889	159,646	217,348	152,710	64,638
U. S. consumption	691,894	278,779	413,115	675,187	277,493	397,692

INDUSTRY BALANCE SHEET Supply and Distribution of Turpentine and Rosin. Turpentine, 50-Gal. Bbl.; Rosin, Drums of 520 Lb. Net



ROSIN REVERSAL Production of Gum and Wood Rosin. Gum Used to Rule the Roost. No More. (Fiscal Years Ended March 31)

Western Progress

Troubles Take Toll; Banner Year Anyway

OUTPUT of chemicals in the West reached a new high in 1947: (1) many new plants and expansions went on stream after agonizing delays caused by materials and equipment shortages; (2) the industry was largely free of the wave of paralyzing strikes that featured the previous year; (3) raw materials eased up in most lines; (4) the rapid industrial and population growth has created new and expanded markets that kept most plants operating at capacity. Further increases in output along most lines will feature 1948—assuming no widespread recession.

Sulphuric acid plants, with one or two exceptions, operated at capacity. Output was probably more than 35 percent greater than for 1946, when a particularly ornery strike situation crippled the industry. More new capacity will come in during this year and 1949.

Soda ash output was increased considerably by new producers that began operations largely during the second half of the year. Outlook for this chemical is bright for the coming year: the largest producer has a major expansion that will add considerably to the output and new producers will be getting into full swing.

Output of salt cake was upped 10-15 percent by present firms and the entry of a new producer at the end of 1947. Other salines, including salt and borates, increased about 10 percent; greater percentage gains will be chalked up for the present year, especially for borates and salt cake.

Caustic soda and chlorine had a plus-and-minus record. Two new plants went into operations and another producer expanded output considerably. On the other hand, one major producer has been forced to operate at 50 percent capacity or less since midsummer because of a temporary power shortage. The net result was an increase in chlorine output of about 20 percent. This year should show a major gain in caustic-chlorine production: (1) the power shortage is about over; (2) at least one expansion will be able to go on stream; (3) new producers and units will be in full swing; (4) new uses are still appearing, present ones growing.

The ammonia year was not a happy one. The major producer completed a doubling of capacity to take care of the West's needs for agricultural nitrogen — almost immediately all three producers in California were cut back to 50 percent or less capacity by a power shortage. Total output just about equaled that for 1946. This year should be a much happier one for producers and agriculture: (1) the power shortage is about over; (2) the expanded capacity completed in 1947 will make its weight felt; (3) an additional 50 percent increase in capacity by the major producer is scheduled to be completed this summer.

For major new projects in the West that went into production or were under construction during 1947, see the accompanying table.

DEPARTMENT OF VITAL STATISTICS

Major Chemical Plants in the West*

Births — Projects Going Into Production During 1947

Firm, Plant Location	Products	Status**
Amecco Chemicals, Inc., Henderson, Nev.	Chlorinated organics	NU
Arapahoe Chemicals, Inc., Boulder, Colo.	Fine organics	NP
Best Fertilizers Co., Oakland, Calif.	Ammonium sulphate	NU
City of Phoenix, Arizona	Iron sulphates	NP
Colorado Fuel & Iron Corp., Denver, Colo.	Caustic, chlorine	E
Colorado Fuel & Iron Corp., Denver, Colo.	DDT	NP
Columbia Metals Co., Salem, Ore.	Ammonium sulphate	NU
Combined Metals Reduction Co., Stockton, Utah	Fossil resins	NP
Coulter, Harden & Co., Henderson, Nev.	Metal chlorides	NU
Culligan Zeolite Co., San Bernardino, Calif.	Zeolite	E
Cutter Laboratories, Berkeley, Calif.	Penicillin	E
Dow Chemical Co., Pittsburg, Calif.	Xanthates	E
Dow Chemical Co., Seal Beach, Calif.	Iodine	E
Electro Metallurgical Corp., Portland, Ore.	Calcium carbide	E
Eston Chemicals, Inc., Los Angeles, Calif.	Organic insecticides	NU
Hooker, Detrex, Inc., Tacoma, Wash.	Trichlorethylene	NU
International Min. & Chem. Corp., San Jose, Calif.	Monosodium glutamate	NP
Julius Hyman & Co., Denver, Colo.	Chlordane	NU
Leslie Salt Co., Newark, Calif.	Salt	E
Lodi Fertilizer Co., Farmington, Utah	Superphosphate	NP
Montrose Chemical Co., Henderson, Nev.	Chloral, chlorbenzenes	NU
Montrose Chemical Co., Torrance, Calif.	DDT	NP
National Chlorides Co., Amboy, Calif.	Calcium chloride	NP
Nevada Chemical Co., Mina, Nev.	Salt cake	NP
New York-Ohio Chemical Co., Dominguez, Calif.	Liq. aluminum chloride	NU
New York-Ohio Chemical Co., Henderson, Nev.	Anhy. aluminum chloride	NU
Oronite Chemical Co., Richmond, Calif.	Syn. detergent	NP
Pacific Carbide & Alloys Co., Portland, Ore.	Calcium carbide	E
Pacific Coast Borax Co., Boron, Calif.	Borates	E
Pennsylvania Salt Mfg. Co., Portland, Ore.	Caustic, chlorine, DDT	NP
Permanente Metals Corp., Lone Pine, Calif.	Soda ash	NP
Permanente Metals Corp., Tacoma, Wash.	Aluminum	E
Permanente Metals Corp., Permanente, Calif.	Fused phosphate	E
Portland Gas & Coke Co., Portland, Ore.	Byproduct chemicals	E
Puget Sound Pulp & Timber Co., Bellingham, Wash.	Alcohol	E
Shell Chemical Corp., Shell Point, Calif.	Ammonia & sulphate	E
Shell Chemical Corp., Dominguez, Calif.	Isopropyl alcohol	E
Shell Chemical Corp., Martinez, Calif.	T-butyl alcohol, diisopropylamine	E
Stauffer Chemical Co., Vernon, Stege, Calif.	Superphosphate	E
Stauffer Chemical Co., Henderson, Nev.	Caustic, chlorine	E
Tacoma Powdered Metals Co., Tacoma, Wash.	Electrolytic iron	NP
U. S. Vanadium Corp., Bishop, Calif.	Tungstates	E
Western Electrochemical Co., Henderson, Nev.	Manganese sulphate	NU
Westvaco Chlorine Prod. Corp., Rock Springs, Wyo.	Trona, soda ash	NP

Deaths — Projects Temporarily Closed or Abandoned During 1947

American Chrome & Magnesium Corp., Mead, Wash.	Magnesium
Acetylene Chemicals, Inc., Portland, Ore.	Acetic, acetaldehyde
Columbia Metals Co., Salem, Ore.	Alumina
Monolith Portland Midwest Co., Laramie, Wyo.	Alumina
Northwest Chemurgy Coop., Wash., Ore., Calif.	Glucose
Pan-Chemical Co., Claremont, Calif.	Strontium salts
Permanente Metals Corp., Permanente, Calif.	Magnesium
Reynolds Metals Co., Troutdale, Ore.	Aluminum
Shell Chemical Corp., Los Angeles, Calif.	Butadiene
Southern California Gas Co., Los Angeles, Calif.	Butadiene
Stauffer Chemical Co., San Francisco, Calif.	Tartrates
U. S. Rubber Co., Los Angeles, Calif.	Synthetic rubber
Willamette Valley Wood Chem. Co., Springfield, Ore.	Alcohol

Expectants — Projects Under Construction or Announced During 1947

Alberta Salt Co., Lindbergh, Alta.	Salt	NP
American-Marietta Co., Culver City, Calif.	Alcohol	E
American Potash & Chem. Corp., Trona, Calif.	Soda ash, borates	E
Carborundum Co., Vancouver, Wash.	Silicon carbide	NP
De Angelis Coal Co., Ione, Calif.	Wax	NP
Dow Chemical Co., Pittsburg, Calif.	Caustic, chlorine	E
Garfield Chem. & Mfg. Co., Garfield, Utah	Sulphuric acid	E
International Min. & Chem. Corp., Carlsbad, N. M.	Potassium chloride	E
Oronite Chemical Co., Richmond, Calif.	Phthalic anhydride	E
Pacific Chem. & Fertilizer Co., Honolulu, T. H.	Sulphuric acid	E
Phillipson Retort Mfg. Co., Eugene, Ore.	Wood chemicals	NP
Saskatchewan Minerals, Chaplin, Sask.	Sodium sulphates	NP
Seattle Gas Co., Seattle, Wash.	Byproduct chemicals	NU
Shell Chemical Corp., Martinez, Calif.	Ditertiary butyl peroxide, alkylated phenol	NU
Shell Chemical Corp., Shell Point, Calif.	Ammonia	E
Simplot Fertilizer Co., Pocatello, Idaho	Triple superphosphate	NP
Stauffer Chemical Co., Henderson, Nev.	Benzene hexachloride	NU
Stauffer Chemical Co., Stege, Calif.	Sulphuric Acid	E
Westvaco Chlorine Prod. Corp., Pocatello, Idaho	Phosphorus	NP

*Not necessarily a complete listing. Does not include synthetic resins and related products.
**NP—new plant; NU—new unit; E—expansion.

ACID AND SULPHUR

(*Continued from page 105*)

Baltimore will have a daily capacity of 500 tons in a single unit, and is believed to be the largest single-unit contact plant in the world.

Several experiments with sulphur will be watched with interest. In the past year a few cars a day of molten sulphur have been shipped from the mines in steam-heated insulated tank cars. A small thermal advantage, marked reduction of losses in transit, and freedom from contamination enroute are factors that appeal to certain users. Once the tank car shortage is overcome, this type of shipment will probably increase. Another sort of experiment has been tried in a number of plants in an effort to improve the burning of sulphur. Although most modern plants now burn molten sulphur which is settled to remove dirt that would interfere with the burning, settling is not entirely effective and several plants have been trying filtration of the molten sulphur with considerable success. The scheme of employing a sublimer in conjunction with a filter has also been used by one producer and it appears possible that a sublimer without a filter might be substituted for the customary burning equipment, permitting the sulphur to be burned in vapor form like so much gas.

The possibility of a new product for sulphuric acid plants is suggested by reports that the General Chemical Co. has developed a method for producing and shipping SO_3 in either liquid or solid form, for sulphonations, or perhaps for economic transport and eventual conversion into acid.

Advocates of "tonnage oxygen" have been stirred by reports of the oxygen-SO_2 acid plant that has been operated by Consolidated Mining and Smelting Co. Ltd. at Trail, B. C., since the early part of the war. Needing greater acid output, this concern converted an old 35-ton contact plant to a closed cycle supplied with oxygen and pure SO_2, increasing its capacity nearly six times in so doing. Interesting as the process is, however, its success depends on peculiarities of the situation at Trail (to be described in a future article in this magazine). Hence, there is little likelihood that the process is indicative of a future pattern for other plants.

So much emphasis on sulphuric acid might leave the impression that the other mineral acids are of no interest today, which is certainly not the case. Nitric acid has been very heavy on account of the ammonium nitrate program for fertilizer, reaching an estimated 747,000 tons, which is 30 percent over 1946, the next largest year. Hydrochloric acid, estimated at 340,000 tons, was about equal to 1946, but considerably below the 407,551-ton peak in 1947. A large part of today's production is byproduct. Hydrofluoric acid, estimated at 27,000 tons, is 26 percent over 1946, but well below the 45,600-ton peak in 1944 when the HF alkylation process was going into operation.

ALKALIS AND CHLORINE

(*Continued from page 107*)

crease of nearly 16 percent, water softeners 11 percent and petroleum refining 10 percent. Although the ash going to nonferrous metals (chiefly aluminum) was much below that of the war years, the increase was 36 percent as compared with 1946. Exports were controlled by the government and advanced 37 percent, but would have been higher if the ash had been available. There was practically no change in the 1,130,000 tons of ash estimated as going into the bicarbonate and lime-soda operations at alkali plants, and an 8 percent decrease in textiles.

Our estimate for bicarbonate production indicates 188,000 tons in 1947, compared with 188,945 tons in 1946, which takes cognizance of the oversold condition of this material during the summer months. In caustic soda the situation was quite different. Lime-soda caustic is estimated (on 10 months' figures) at 745,000 tons compared with the 742,932 tons of 1946, but chlorine's continuing rise brought with it a large increase, from the 1,129,956 tons of 1946 to an estimated 1,335,000 tons in 1947, for electrolytic caustic. The indicated total, 2,080,000 tons, was thus almost 10 percent over the earlier peak of 1944. This meant considerable increases in most consuming departments, with a slight decrease only in textiles. Exports, under government control, were more than doubled while the next largest increase tonnagewise was in chemicals where many new synthetics are requiring caustic in quantity. Despite the somewhat easier position of caustic, its frequent scarcity had its corollary effects, resulting for example at times in a shortage of synthetic phenol. Caustic usage in soap advanced about 22 percent and in rayon and cellophane, over 11 percent. Pulp and paper took an estimated 13 percent greater quantity than in 1946 and petroleum refining, 7 percent.

Chlorine still gives evidence of being the tail that wags the dog, although this does not mean a caustic excess at present. Despite its phenomenal rise during the '20's and middle '30's, chlorine men used to worry prior to World War II because chlorine was more a tool than a reagent. It went into bleaching, into sanitation and water treatment, and into organic reactions where it served as a lever—but reappeared as HCl. It seldom stayed in the product. Then the war years brought a tremendous increase in chlorinated compounds—degreasing solvents, plastics, silicones, synthetic rubbers—and the almost vertical trend was resumed. From 1929 to 1947 the increase was 700 percent, the last year seeing a production of some 1,375,000 tons which might have been larger except for the chlorine car shortage. About 8 percent above the 1944 peak, this output compares with 1,182,000 tons in 1945 and 1,165,126 tons in 1946. Calculation from the coproduced electrolytic caustic suggests that in the neighborhood of 185,000 tons must have been produced in caustic potash cells and by Solvay's nitrosyl chloride process.

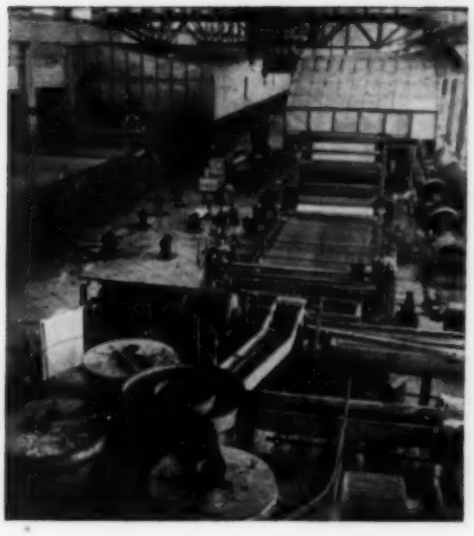
Chlorine Consumption

Interesting in contrast with earlier years is our estimate of how this record-breaking chlorine tonnage was consumed. Such a rise in chemical use has come about, that we now estimate that about 72 percent of chlorine was consumed in chemicals, with about 15 percent each in pulp and paper, 5 percent each in bleaching and in water and sewage treatment, 1 percent in textile uses, and 2 percent in miscellaneous uses including exports.

With a single exception, technical trends in alkali production in recent years have not shown much change. The exception lies in the rising interest in the mercury cell as a means of producing salt-free caustic. Mercury cells, extensively used in Germany (but mainly because the Axis countries had no asbestos for diaphragms), were thoroughly investigated by U. S. producers immediately after the war. Mathieson introduced its own mercury cell, which had been under development for a number of years, although not used extensively. Mercury cell use appears to be on the verge of considerable expansion, although the introduction of a new member of the Hooker Type S series may indicate that for most purposes the diaphragm cell is by no means on the way out.

Photos furnished by Sovfoto

SODA—Damaged by war, the Slavyanska soda works is back in production



PAPER—Utilizes vast forest reserve

Russian Chemical Industry

DESPITE SHORTAGES, CHEMICAL INDUSTRY IS ACHIEVING ITS PRODUCTION QUOTAS

KARL FALK
Fresno State College, Fresno, Calif.

Reconstruction and expansion are the chief objectives of the Russian chemical industry now entering the third year of the Fourth Five-Year Plan (1946-1950). Scheduled to boost output 50 percent above prewar levels, this program indicates the importance placed on the chemical industry.

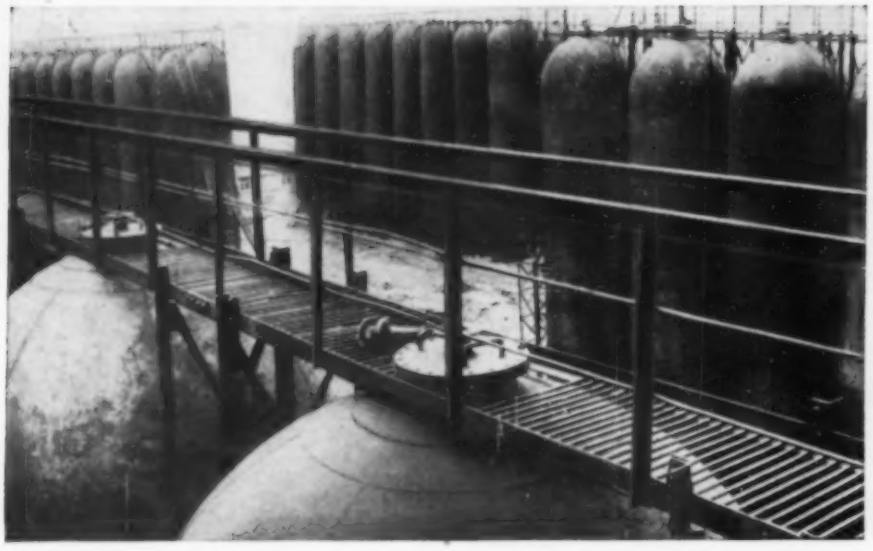
CEMENT—New kiln aids production

ATTAINING military self-sufficiency and geographic security as well as supplying necessary chemicals to keep pace with general industrial production increases are important considerations in the current Fourth Five-Year Plan. Priority in building new plants as well as reconstructing and expanding old ones will be accorded basic chemicals, especially for fertilizers, but eventually a high degree of self-sufficiency even for consumer-goods chemicals is scheduled. In the meantime, the Russians, despite political coolness, would not be averse to importing American consumer-goods, chemicals, machinery, equipment, and know-how. Lack of these items as well as shortages of manpower, fuel, electric power, and construction materials are among the biggest handicaps in executing Soviet plans. Russian control of part of western and central Europe, as will be pointed out later, is helping the Russians to overcome some of these difficulties.

During the war, output of synthetic ammonia, sulphuric acid, nitric acid, superphosphate, ammonium phosphate, ammonium nitrate, sodium nitrate, calcium carbide, cyanamide, paint, fertilizers, and plastics was pushed. Postwar plans, in addition to emphasizing basic heavy chemicals and fertilizers, call for greatly increased production of synthetic oil, several kinds of rubber, plastics, alcohol, by-products of coke ovens, petroleum, and natural gases. Specific branches also marked for considerable expansion are aniline dyes and pharmaceuticals.

Fertilizers

Raising fertilizer and agricultural chemical output is the major item in the current plan, which calls for increases over prewar levels by 1950 of 100 percent for superphosphates, 80 percent for nitrates, and 30 percent for potassium fertilizers. By 1950



NATURAL GAS—Batteries of gas holders being completed near Moscow

SULPHURIC ACID dept. of large plant

combined output of these three is expected to reach 5,000,000 tons plus 400,000 tons powdered phosphorite. In fact, half the total capital outlay in the Five-Year chemical plans is for fertilizer plants.

War Destruction

The extent of wartime destruction in the Soviet Union is indicated in official reports that when the western provinces were overrun, nitrogen capacity was reduced by 50 percent, sulphuric acid by 77 percent, soda ash by 83 percent, and dyes by 88 percent. However, the Russians did succeed in transferring some chemical equipment to the Urals and to the central region near Moscow, often closer to raw materials than before. Moving even farther east with postwar plants to Central Asia, they are trying to get chemical production closer to some of the consuming centers where it is hoped through increased use of fertilizers to boost the harvest, especially of cotton, tobacco, potatoes, and rubber-yielding plants. About the only indication of the extent of realization of plans so far is the Soviet announcement that mineral fertilizer output in 1946 was 52 percent higher than the low levels of 1945, and 1947 production presumably considerably exceeded that of 1946.

Synthetic Oil and Rubber

Russian interests in synthetic oil—plans call for a yearly output of 900,000 tons—stems from the fact that although the Soviet Union is the world's second largest petroleum producer, its output was seriously curtailed during the war. This sharp drop, it is now revealed, was due not so much to war destruction in the Maikop and Grozny fields as to technical deterioration of production in the Baku area which formerly supplied 70 percent of the USSR's crude petroleum. Nor have the new Volga-Ural fields come up to expectations.

Availability of German know-how, technicians, and equipment—some of Germany's largest synthetic motor fuel plants such as Leuna-Merseburg lie in the Russian-occupied zone—may also account for part of this interest. The shortage of coal as well as the difficulty of transferring heavy equipment from Germany where raw materials are also readily available, may partly account for the temporary continuation of synthetic oil production in the Soviet-occupied zone of the Reich. Incidentally, the heavily-damaged Donetz basin has high priority in the general reconstruction program since it was not only Russia's major coal producer but supplied between 50 and 60 percent of iron ore, pig iron, steel, and aluminum, 20 percent of the nation's heavy machinery, and 25 percent of its electrical energy. Its recovery is therefore closely tied in with the Soviet chemical industry expansion.

Current plans call for doubling Soviet synthetic rubber output, which would be equivalent to 38 percent of the present world total. Russia's synthetic rubber production dates back to 1928. By the outbreak of the war considerable rubber independence had been attained through pushing yields of natural sources as guayule and kok-saghyz as well as of synthetic plants operating chiefly from alcohol from potatoes. In 1931 four synthetic plants were operating in the USSR, four more were added under the Second Five-Year Plan, and 18 more had been called for under the war-interrupted Third Five-Year Plan. 1938 production has been estimated at 100,000 tons by polymerization of butadiene in the presence of metallic sodium. Butadiene, chiefly by the improved Lebedev process, was obtained from alcohol, and by 1939 one ton of butadiene required only 2.8 tons of alcohol as against twice that amount in 1928.

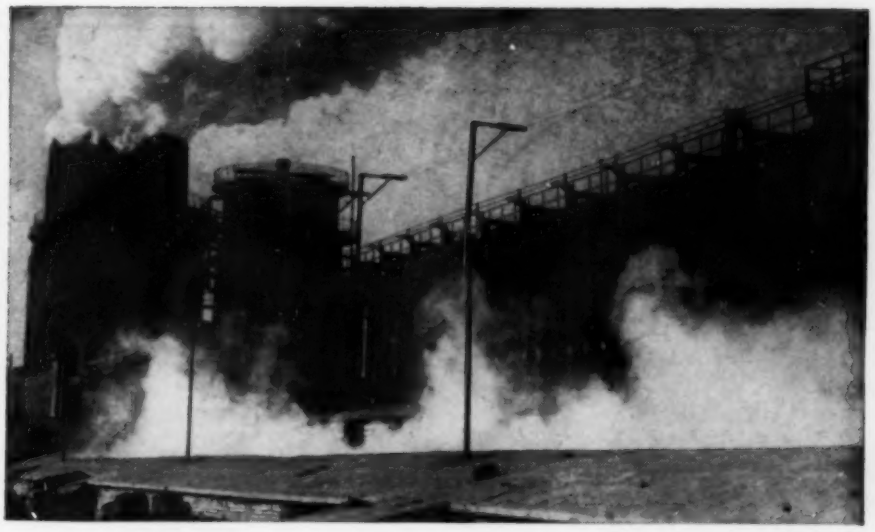
Since the alcohol has been derived from sources competing with food demands, more recent plans call for use of acetylene, natural gas, and cheaper petroleum raw materials. There is considerable room for expansion of Russian consumption as well as production of rubber. In 1937 USSR had the lowest per capita consumption of the major powers with only 0.37 lb. as against 9.9 lb. per person for the United States. As in the case of synthetic oil, Russian occupation of Germany is no liability as far as Soviet plans are concerned. The large German synthetic rubber plan at Schkopau in the Russian zone was reportedly outproducing plants in the British zone early in 1947.

Synthetic Fibers

Large-scale production of synthetic fibers is a relatively new development for the USSR since prewar efforts were directed largely toward boosting natural fiber output. Production of synthetic fibers, especially rayon, is scheduled to be four to five times above prewar levels by 1950.

The Soviet Union has ample raw materials for producing staple fiber from wood as well as for forest prod-

SHALE distillation yields gasoline



COAL CHEMICALS—New coking battery in Kuznotsh coal basin, Siberia

ucts for making ethyl alcohol, acetone, sulphate derivatives, rosin, and terpentine. Despite wartime destruction of forests and difficulties of transport, the possibilities are obvious when one recalls that in European Russia alone, there are nearly 600 million acres of forest land, almost twice that of the rest of Europe combined.

Natural Gas

The postwar Five Year Plan contemplates greatly accelerated prospecting for and greater utilization of natural gas as an industrial and domestic fuel and as a chemical raw material. Two hundred large natural gas deposits throughout the Soviet Union were hardly tapped until wartime fuel shortages require their more intensive exploitation.

Two long-distance pipelines are the 105-mi. line completed in 1944 connecting Buguruslan with Kuibyshev factories, and the recently finished 530-mi. main from the Saratov gas fields to Moscow. Other projected developments include a 300-mi. line from Dashava in the western Ukraine to Kiev, and a 136-mi. main from the Estonian gas fields at Kohlia to Leningrad.

Gas is also being produced in several coal fields by carbonization in the ground. By this method, whose economy has been debated, air and gas passages are drilled from the ground surface, while an oxygen blast has been used to obtain a more intense rate of combustion. This gas has replaced coal in some factories, saving, according to Russians, labor formerly used to transport solid fuel and to remove ashes.

Interest in plastic production, which doubled during the war, is indicated by the fact that 18 new plastic plants were scheduled to be erected in 1947 in the Ukraine alone. A 30 percent increase in dyestuff production to 43,000 tons is contemplated by 1950.

Oil seed production has long been pushed, and new varieties of richer oil-bearing sunflowers and flax are frequently reported by agricultural experimental stations. Much of the sunflower seed oil is fat-hardened for making margarine and soap. Soap output, incidentally, is scheduled to reach 870,000 tons by 1950 (800,000 tons 1940), and it is reported that synthetic fatty acids and soap naphtha will be used where possible to free fats for food.

Geographic Redistribution

It is hard to measure the extent of geographical redistribution of chemical centers eastward in view of the Soviets' traditional shyness in releasing such information. It is known, however, that in 1932 at the start of the Second Five-Year Plan, northwestern Russia was the location of 44 percent and central Russia 42 percent of the Soviet chemical industry. By the end of the Third Five Year Plan in 1942 it had originally been planned to distribute the chemical industry as follows: in northwestern Russia only 15 percent, central Russia 46 percent, Ukrainian republic 10 percent, Urals 6 percent, west Siberia 4 percent, Volga-Vyatka 2 percent. Presumably the war changed these plans and expedited the eastward movement. From 1941 to 1945 the eastward shift and new factories resulted in growth in total industrial output in the Urals of 260 percent and in Siberia of 180 percent, with specific increases in metal fabrication going as high as 600 percent in the Urals and 1,200 percent in west Siberia. A considerable part of the total industrial increase in wartime represented chemical production. The further shift has undoubtedly accelerated in the meantime.

Labor Shift

To induce labor to move eastward as well as to produce more, wages were raised 20 percent in August 1946 in key industries in the Urals, Siberia, and the Far East, with added bonuses for new housing. Lack of housing for workers is reportedly one of the biggest difficulties in shifting Soviet industries eastward.

In this connection some of the other difficulties might be reviewed, for the new Five-Year Plan execution has not been as smooth-running as the percentage figures on attainment of goals might indicate. The magnitude of war damage is probably not fully realized outside Russia. Physical destruction of cities, industrial plants, housing, war-weariness, the loss of an estimated 10 million persons to the labor force through death, injury, incapacitating illnesses, etc., poor harvest due to drought in 1946—all are handicapping the new Five-Year programs. In the chemical industry the shortage of fuels, hydroelectric power, inability of construction industries to keep pace with goals, and lack of domestically - produced machinery, equipment, and precision instruments are a few of the major bottlenecks, to say nothing of lower quality of

(*Continued on page 141*)

I. G. FARBEN plants in Germany before dispersal by the four-power Allied Control Council were closely associated by reason of geographical location as well as by interplant dependency. The Council is endeavoring to dissolve the organization by disposing of its stock interests in some units, disposition of patents, and liquidation of many of the I.G. plants

What About Future of I. G.

JOHN J. CHRISTIE
McGraw-Hill World News, Berlin, Germany

IN LAST month's issue of *Chemical Engineering*, under the heading of "Fabulous I. G. Farben Disintegrates," Mr. Christie reported an on-the-spot account of the advanced stage of dispersal of the I. G. He discussed what lies ahead, attitude of the Soviets, mechanics of dispersal, and effects of reparations on German peacetime capacity. This month Mr. Christie makes an economic and technical appraisal of the dispersal of the great organization.—*Editors.*

Dispersal of the German I. G. Farbenindustrie will not be as drastic as originally intended. The American and British, in keeping with the less punitive attitude which they have developed toward German industry generally, already have ameliorated their Farben policy in certain respects.

It has been decided not to split up large I.G. plants in the two zones as originally planned. For example, Hoechst was to have been made into three independent units: (a) plastics and solvents, (b) nitrogen and fertilizer, and (c) dyestuffs and pharmaceuticals.

Two essential reasons for not taking such action are: 1. It would require heavy expenditure of time and money for alterations and new constructions necessary to make each element self-operating in respect to power supply, rail and dock facilities, etc. 2. It would unduly complicate inter-plant dependency for raw materials and intermediates.

Although there is no indication as yet of official U.S.-British sanction, at least consideration will be given to a German proposal that two groups of large plants in the bi-zonal area be permitted to operate as a sort of combine. One would be composed of the U. S. zone plants of Hoechst, Mainkur and Offenbach and the other the big five I.G. plants in the British zone.

The British, who have moved with noticeable caution in implementing the de-cartelization of Farben, would seem likely to favor such combination in their zone. It is unlikely, however, that they have failed to act on the "big five" in their zone because of any socialization motives on their part.

Probable effects on productive efficiency and costs: German chemical manufacturing attained its stature largely through an ingenious and phenomenal utilization of wastes and of synthetic materials from which an ever widening range of products was developed. These production techniques lent themselves to a high degree of integration and inter-plant dependency which were so characteristic of the I.G. combine. The merger which created the combine attempted to rationalize production by assigning to each installation those products which it could make most economically. Thus, a considerable portion of the output of many plants represented only rudiments or fragments of ultimate products.

Inter-Plant Dependency

The most troublesome factor which the creation of independent units appears to have introduced is in respect to inter-plant dependency. As an independent unit a plant tends to put more emphasis on its own salable end products than on the intermediates on which other plants traditionally depend for their production. This, of course, works both ways. However, some plants are more vulnerable than others. Already it is common for plants to charge each other with "squeeze play" and "monopolistic" practices in connection with the exchange of intermediates.

Postwar production planning by many former I.G. units, as well as their reconstruction planning consequently is characterized by the desire to be more self-sufficient in raw materials and intermediates. Also, the desire to produce a wider range of salable end products is influencing their planning. In some cases, little or no alteration of productive facilities is necessary to achieve the aims, while in other instances, alterations and expansion would require a considerable outlay of new capital.

This problem undoubtedly will be mitigated somewhat by an over-all improvement in availability of raw materials and a more stable economy generally. And, if certain units are permitted to operate in combine, difficulties may be lessened further. A trend toward greater self-sufficiency, nevertheless, can be expected.

Those who take a realistic view of the matter, including a good many Farben production men, are confident that the former Farben units will be able to operate efficiently and economically, after they have passed through the inevitable period of readjustment to the new conditions wrought by the combine's dispersal.

Certain higher cost factors, however, can be expected as a consequence of the de-centralization. From a production standpoint at least two can be forecast: (1) Intermediates will be exchanged on a competitive and profit basis instead of as automatic exchanges at cost price, and (2) In order to decrease their dependency and become more self-sufficient otherwise, some plants undoubtedly will be manufacturing certain products at a cost higher than they were made under the old set-up. Also, under the new production pattern, utilization of by-products will not be carried to the same extreme.

From a marketing standpoint, the cost of doing business may be expected to increase somewhat as a result of the abolition of central sales organizations. However, these higher cost factors need not increase the selling price of most products. Farben manufacturing techniques kept cost prices unusually low, permitting a considerable mark up but still not resulting in unreasonable selling prices. A study of Farben trade practices shows no evidence of gouging the public on prices even though it was a monopoly. Thus higher cost factors should be absorbed easily through reduction of mark ups.

It is interesting to note also, in appraising future cost factors, that U.S. chemical engineers who have been dealing with Farben units for military government have noted a number of inefficiencies which if corrected would effect savings. Most of these inefficiencies stem from antiquated practices in utilization of manpower and lack of laborsaving devices such as automatic controls in the plants.

Process Engineer's Guide to the Centrifugal Compressor—V

CONCLUDING A COMPREHENSIVE SERIES, THIS ARTICLE SHOWS HOW NECESSARY PERFORMANCE CHARACTERISTICS CAN BE CALCULATED

IGOR J. KARASSIK

Application Engineer
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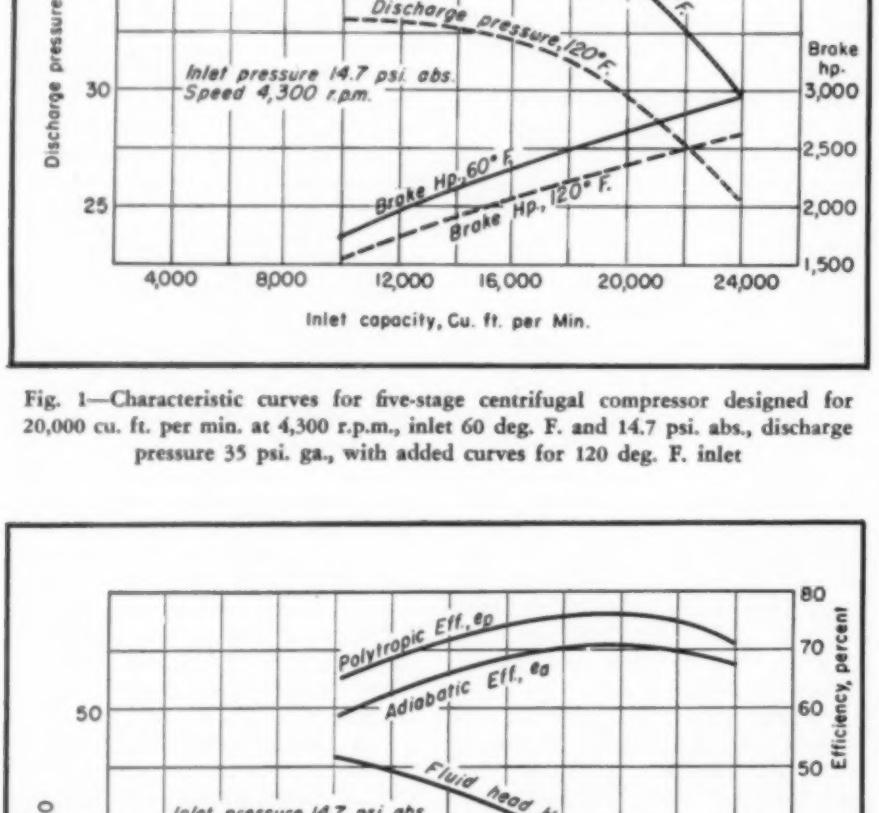

Fig. 1—Characteristic curves for five-stage centrifugal compressor designed for 20,000 cu. ft. per min. at 4,300 r.p.m., inlet 60 deg. F. and 14.7 psi. abs., discharge pressure 35 psi. ga., with added curves for 120 deg. F. inlet

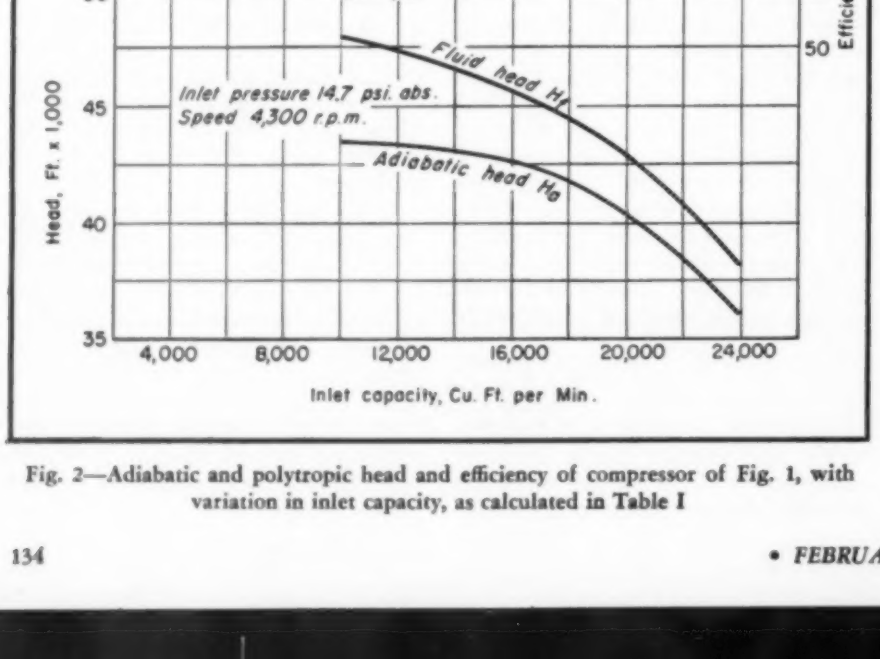

Fig. 2—Adiabatic and polytropic head and efficiency of compressor of Fig. 1, with variation in inlet capacity, as calculated in Table I

PERFORMANCE characteristics of centrifugal compressors are generally presented graphically in the same manner as those of centrifugal pumps, except for the fact that instead of the total head, as in the case of pumps, the discharge pressure in pounds per square inch (gage or absolute) is plotted against the inlet capacity at constant speed. This method of presentation, however, is not sufficient to predict the compressor performance under all conditions without additional calculations, since any change in inlet pressure, temperature or speed will change the discharge pressure and the brake horsepower materially. Pressure-versus-capacity curves may be used for such predictions if methods similar to those for adjusting data from test conditions to contract conditions are used, as outlined in the Compressed Air Institute Standards and in the ASME Power Test Code PTC-10. However, a more complete picture of this performance and a fuller understanding of the principles involved may be obtained if we illustrate how the performance of any given compressor can be calculated from the single set of curves mentioned above.

It must be remembered first of all that while an earlier article has presented a complete discussion of adiabatic and fluid heads, these are strictly calculated—not observed—values. The test of a centrifugal compressor, operated at constant speed with constant inlet pressure and inlet temperature, yields the familiar characteristic curve of discharge pressure and brake horsepower versus inlet capacity. Such a curve is presented in Fig. 1, which illustrates the performance of a five-

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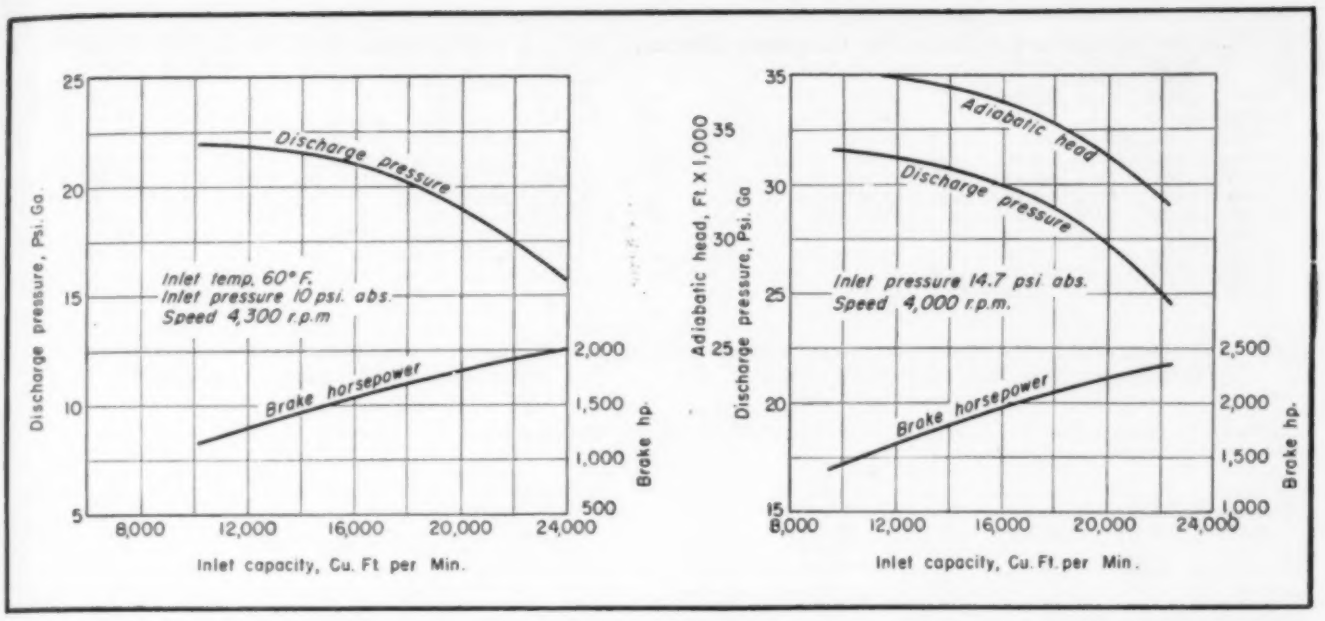


Fig. 3—Effect of reduction in inlet pressure on discharge pressure and brake horsepower

Fig. 4—Effect of speed change on brake horsepower, discharge pressure and adiabatic head

In this fifth and concluding article on the calculations and principles of the centrifugal compressor that are involved in a thorough "application" understanding of this important process tool, Mr. Karassik shows how, from a simple chart of brake horsepower and discharge pressure versus inlet capacity, it is possible to derive all the important quantities that must be dealt with. The four earlier articles appeared in our issues of October, November, December 1947, and January 1948.

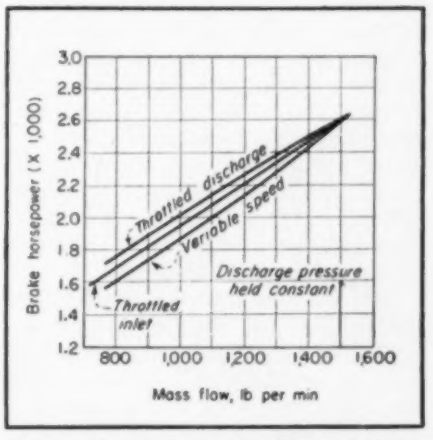


Fig. 5—Comparison of effect of three control methods on power requirements

stage compressor designed to compress 20,000 cu.ft. per min. of air under inlet conditions of 14.7 psi. abs. and 60 deg. F., to 35 psi. ga. at 4,300 r.p.m.

From this curve, it is possible to calculate, for any given inlet capacity and in the following order: (1) the ratio of compression r; (2) the adiabatic head H_a; (3) the adiabatic horsepower Ad. Hp.; and (4) the adiabatic efficiency e_a. For example, at the design inlet capacity of 20,000 cu.ft. per min., $r = (14.7 + 35)/14.7 = 3.38$. From Fig. 2, Part II (Nov., p. 133), $H_a/T_1 = 77.7$. Then $H_a = 77.7 \times (460 + 60) = 40{,}450$ ft. The specific volume of dry air at 14.7 psi. abs. and 60 deg. F. is 13.09 cu.ft. per lb. Therefore the mass flow is=20,000/13.09= 1,530 lb. per min.

Adiabatic horsepower equals the mass rate of flow in lb. per min. times the adiabatic head divided by 33,000, or Ad. Hp. = (1,530 × 40,450)/33,000 = 1,875. From Fig. 1 we read B. Hp. = 2,640. Adiabatic efficiency $e_a = 1{,}875/2{,}640 = 0.71$ (71 percent).

Repeating these calculations for various inlet capacities, as shown on Table I, we can complete the data required to plot a curve of adiabatic head and adiabatic efficiency versus capacity, and such a curve is shown in Fig. 2.

Knowing the value of k and the adiabatic efficiency e_a, the value of the polytropic exponent n can be determined for all flows by the method described in Part IV (Jan., page 119), getting first the approximate and then the actual values. These calculations are shown for the entire range of flows in Table I and the values for e_p, the polytropic efficiency, and H_f, the fluid head, are superimposed on Fig. 2.

If the performance of a centrifugal compressor is described by a curve of adiabatic head and adiabatic efficiency plotted against the inlet capacity, this curve will remain independent of inlet pressure variations with inlet temperature remaining constant, if we are to neglect the effects of supercompressibility. This statement is less exact, however, when the inlet temperature varies, particularly in the case of a multi-stage compressor. The reason for this is that the fluid head of any given stage of a multi-stage compressor, at any given inlet capacity, is fixed by the design characteristics of that stage. At the same time, the ratio of compression which will result from that fluid head will vary with inlet temperature since the fluid head equals:

$$H_f = RT_1 \left(\frac{n}{n-1}\right)(r^{(n-1)/n} - 1)$$

As the temperature rise through that given stage is also a function of the inlet temperature, it follows that the volume at the inlet of the succeeding stage will vary with inlet temperatures, even though the inlet volume at the preceding stage remains unchanged. This change in volume carries with it a change of fluid head as well as of efficiency for that stage, with the result that the combined performance characteristics of the compressor become somewhat altered.

We must, however, recall that the aim of this study is to simplify centrifugal compressor calculations and that therefore certain liberties are per-

Table I—Performance Calculations for Compressor Illustrated in Fig. 1, Inlet Conditions 14.7 Psi. Ga. and 60 Deg. F.

Inlet Capacity, C.F.M.	Mass Flow, Lb. per Min.	Disch. Press., p_2, Psi. Ga.	Comp. Ratio, r	H_a/T_1	Adiab. Head, H_a, Ft.	Ad. Hp.	B. Hp.	Adiab. Eff., e_a, %	Approximate: Poly. Exp't., n	H_f/T_1	Fluid Head, H_f, Ft.	Poly. Eff., e_p, %	Actual: Poly. Exp't., n	H_f/T_1	Fluid Head, H_f, Ft.	Poly. Eff., e_p, %
10,000	765	39.0	3.66	83.6	43,400	1,005	1,710	58.9	1.92	95.5	49,600	67.4	1.73	92	47,900	65.0
12,000	918	38.8	3.64	83.2	43,200	1,200	1,900	63.2	1.805	94	48,900	71.5	1.66	91	47,250	69.2
14,000	1,070	38.5	3.615	82.8	43,000	1,395	2,100	66.5	1.74	92.3	48,000	74.2	1.62	89.5	46,500	71.7
16,000	1,222	37.8	3.575	82.1	42,700	1,580	2,300	68.7	1.70	90.4	47,000	76.0	1.59	88.5	46,000	74.0
18,000	1,378	36.8	3.50	80.3	41,750	1,740	2,470	70.5	1.67	87.7	45,600	77.0	1.58	85.5	44,500	75.0
20,000	1,530	35.0	3.38	77.7	40,450	1,875	2,640	71	1.66	84.6	44,000	77.3	1.575	82.5	42,900	75.4
22,000	1,682	32.7	3.22	74.0	38,450	1,960	2,780	70.5	1.67	80.4	41,800	76.5	1.585	78.6	40,900	75.0
24,000	1,836	29.7	3.02	69.2	36,000	2,000	2,940	68	1.715	75	39,000	73.6	1.63	73	38,000	71.7

Table II—Effect of Inlet Pressure Reduction on Compressor Performance (Inlet Pressure = 10 Psi. Abs.)

Inlet Capacity, C.F.M.	Comp. Ratio, r	Disch. Press., p_2: Psi. Abs.	Psi. Ga.	B. Hp.	Mass Flow, Lb. per Min.
10,000	3.66	36.6	21.9	1,162	520
12,000	3.64	36.4	21.7	1,293	625
14,000	3.615	36.15	21.45	1,428	728
16,000	3.575	35.75	21.05	1,562	833
18,000	3.50	35.0	20.3	1,680	936
20,000	3.38	33.8	19.1	1,795	1,040
22,000	3.22	32.2	17.5	1,890	1,145
24,000	3.02	30.2	15.5	2,000	1,250

Table III—Effect of Inlet Temperature Change on Compressor Performance (Inlet Temp. = 120 Deg. F.)

Inlet Capacity, C.F.M.	Adiab. Head, H_a, Ft.	H_a/T_1	Comp. Ratio, r	Disch. Press., p_2: Psi. Abs.	Psi. Ga.	Mass Flow, Lb. per Min.	B. Hp.
10,000	43,400	74.8	3.25	47.8	33.1	685	1,533
12,000	43,200	74.5	3.24	47.6	32.9	823	1,705
14,000	43,000	74.1	3.22	47.3	32.6	960	1,885
16,000	42,700	73.5	3.19	46.9	32.2	1,096	2,065
18,000	41,750	72.0	3.125	46.0	31.3	1,232	2,215
20,000	40,450	69.6	3.03	44.5	29.8	1,370	2,370
22,000	38,450	66.4	2.91	42.8	28.1	1,509	2,495
24,000	36,000	62.0	2.73	40.2	25.5	1,645	2,640

missible if their net result is to serve this aim without introducing an excessive error. Since it would be extremely complex to break down the performance of a multi-stage compressor into the performance of its individual stages, and since only a very small error is introduced by assuming that a change in inlet temperature has no effect on the adiabatic head and efficiency of the compressor as a whole, such an assumption is quite justifiable for all practical calculations.

We are now ready to establish the performance of the compressor described in Figs. 1 and 2 under variable inlet temperature and pressure conditions. If we keep the inlet temperature constant and change only the inlet pressure, the ratio of compression will not change and we can readily calculate the new discharge pressure and brake horsepower. For instance, let us assume that the inlet pressure of the compressor is reduced to 10 psi. abs. At 20,000 cu.ft. per min. the ratio of compression $r = 3.38$ and the discharge pressure will be $10 \times 3.38 = 33.8$ psi. abs. or 19.1 psi. ga. The mass flow at this capacity will be reduced in direct proportion to the inlet pressure and both the adiabatic and brake horsepower will be reduced in the same proportion.

Thus, at 20,000 cu.ft. per min., Ad. Hp. $= 1,875 \times 10.0/14.7 = 1,275$ and B.Hp. $= 2,640 \times 10.0/14.7 = 1,795$. These calculations are repeated for all flows in Table II and the resulting curve shown in Fig. 3.

If, instead of varying the inlet pressure, we had changed the inlet temperature and if we assume that the curve of the adiabatic head plotted versus the capacity remains unchanged, the ratio of compression will vary. For instance, assume that the inlet temperature is increased to 120 deg. F. At 20,000 cu.ft. per min. the adiabatic head is 40,450 ft. Then $H_a/T_1 = 40,450/(460 + 120) = 69.7$. From Fig. 2, Part II (Nov., p. 133), the ratio of compression $r = 3.03$. The discharge pressure becomes $14.7 \times 3.03 = 44.6$ psi. abs. or 29.9 psi. ga. Since the mass flow is reduced in an inverse proportion to the absolute temperature, while the head in ft.-lb. per lb. (i.e., ft.) remains unchanged, the adiabatic and brake horsepower are also reduced in the same proportion. Thus: B.Hp. $= 2,640 \times (460 + 60)/(460 + 120) = 2,370$. As in the case of the effect of inlet pressure variation, these calculations are repeated for all flows in Table III with the results on Fig. 1.

Table IV—Effect of Speed Change on Compressor Performance (Speed = 4,000 R.P.M.)

Inlet Capacity, C.F.M.	Adiab. Head, H_a, Ft.	H_a/T_1	Comp. Ratio, r	Disch. Press., p_1: Psi. Abs.	Psi. Ga.	B. Hp.
9,300	37,600	72.4	3.15	46.4	31.7	1,378
11,200	37,400	72	3.13	46	31.3	1,530
13,000	37,200	71.5	3.11	45.7	31.0	1,690
14,900	37,000	71	3.08	45.3	30.6	1,850
16,750	36,150	69.5	3.03	44.5	29.8	1,990
18,600	35,000	67.4	2.95	43.4	28.7	2,120
20,500	33,300	64	2.81	41.4	26.7	2,240
22,350	31,200	60	2.66	39.2	24.5	2,365

Effect of Speed

With certain approximations and within limits, the similarity between centrifugal compressors and centrifugal pumps holds also in connection with the effect of speed changes on the performance of the machine. In the fluid head–inlet capacity curve of a single-stage compressor, the relation of Q, H_f and B.Hp. follows the standard centrifugal machine relations with respect to changes of speed, or $Q_1/Q_2 = n_1/n_2$; $H_{f1}/H_{f2} = (n_1/n_2)^2$; and $B.Hp._1/B.Hp._2 = (n_1/n_2)^3$. In a multi-stage compressor, however, such relations are only approximate for the same reasons that were outlined in the case of variations in inlet temperature. In other words, as a change of speed changes the fluid head developed by the first stage, the developed ratio of compression and the temperature rise which occur in that stage also change. Thus, the relations between inlet capacities at the various stages no longer remain the same as they were at the former speed and the performance of the stages other than the first no longer follows the indicated speed relations.

However, as in the case of inlet temperature variations, it is generally assumed that these speed relations hold, as long as the speed changes are not too great. It is furthermore assumed that the same relations prevail with respect to the adiabatic heads, so that $H_{a1}/H_{a2} = (n_1/n_2)^2$. As an illustration, Table IV and Fig. 4 indicate the predicted performance of the compressor of Figs. 1 and 2 at a speed of 4,000 r.p.m. assuming no changes in inlet temperature or pressure.

While it is not intended to present here a complete description of all the

Table V—Effect of Throttling Inlet Pressure at Constant Discharge Pressure on Compressor Performance

Inlet Capacity, C.F.M.	Comp. Ratio, r	p_1 Psi. Abs.	Mass Flow, Lb. per Min.	B. Hp.
10,000	3.66	13.55	705	1,574
12,000	3.64	13.65	852	1,760
14,000	3.615	13.75	1,002	1,966
16,000	3.575	13.9	1,155	2,175
18,000	3.50	14.2	1,330	2,380
20,000	3.38	14.7	1,530	2,640

Table VI—Effect of Variable Speed on Performance With Constant $r = 3.38$ and Constant $H_a = 40{,}450$ Ft.

Inlet Capacity, C.F.M.	Speed, R.P.M.	Ad. Hp.	e_a	B. Hp.	Mass Flow, Lb. per Min.
10,000	4,140	937	60	1,560	765
12,000	4,150	1,125	63.5	1,770	918
14,000	4,170	1,310	67	1,955	1,070
16,000	4,200	1,500	69.2	2,170	1,222
18,000	4,250	1,690	70.8	2,390	1,378
20,000	4,300	1,875	71	2,640	1,530

controls which may be applied to the operation of a centrifugal compressor, it may be interesting to carry through a comparison of the various means available for its regulation. Let us assume, for example, that it is desired to operate the compressor described in Fig. 1 at various mass flows but always at a constant discharge pressure. Let us further assume that no changes in inlet temperature take place during this operation. We may then (1) throttle the discharge pressure; (2) throttle the inlet pressure; or (3) vary the compressor speed.

Compressor Regulation

In the first case, the performance indicated on Fig. 1 will not change and we will merely throttle off the excess pressure which is developed at reduced capacities without reducing the power consumption of the machine.

In the second case, if the compressor speed remains constant, the adiabatic head and the compression ratio at any given volume flow measured at the compressor inlet (after the throttling) likewise remain constant, assuming that the throttling is so arranged that flow distribution to the compressor impellers is not affected. We can then find the required inlet pressure p_1, to give a constant discharge pressure, from the relation $p_1 = p_2/r = (35 + 14.7)/r$. Thus, at 10,000 cu.ft. per min., $r = 3.66$ and the inlet pressure must be reduced from 14.7 to 13.55 psi. abs. Since the mass flow changes directly with the inlet pressure, it will be reduced in the ratio of 13.55 to 14.7 and becomes $765 \times 13.55/14.7 = 705$ lb. per hr.

The adiabatic horsepower will be reduced in the same ratio and so will the brake horsepower, since the adiabatic efficiency at the volume flow measured after the throttle has not changed. Repeating these calculations for all flows, we can obtain a complete tabulation of the required inlet pressures and of the resulting power consumption. These data are given in Table V.

If, on the other hand, the centrifugal compressor is driven by a variable-speed machine, such as a steam turbine, it becomes possible to operate the compressor at such speeds that the discharge pressure will remain constant at all flows. This will require that, with a constant inlet pressure, we maintain a constant compression ratio and therefore a constant adiabatic head. We may point out here the advantages of the assumption that the adiabatic head follows the same relation with speed changes as the fluid head. It must be considered that a constant adiabatic head at all flows does not mean a constant fluid head, since the latter is related to the former through the compressor efficiency and since this efficiency falls off with a reduction in capacity. Thus, even though we obtain a constant adiabatic head by varying the speed, the fluid head will increase at reduced capacities. Unfortunately, the only means at our disposal for constructing the fluid head curve corresponding to a constant adiabatic head is a trial and error method. On the other hand, the error introduced by the assumption mentioned above is relatively negligible.

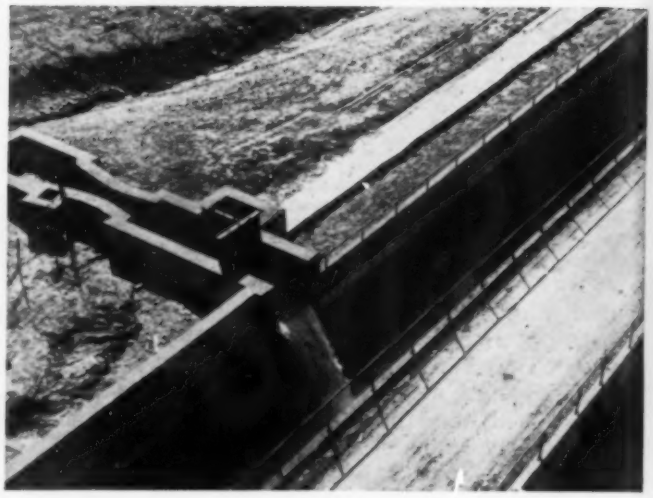
The method followed in calculating the change in speed required to obtain a given head and capacity, once the performance of the compressor at some other speed is known, differs in no way from that used in the calculation of centrifugal pump performance. A short section of the parabola describing the relation $Q_1/Q_2 = (H_{a1}/H_{a2})^{1/2}$ is drawn through the head-capacity point at which it is desired to find the operating speed, in such a manner that it intersects the head-capacity curve at constant (known) speed. The new speed will bear the same relation to the known speed as the square root of the desired head to the square root of the head at the point of intersection. The new adiabatic efficiency will be the efficiency at the capacity corresponding to the intersection. (See Table VI.)

We are now in a position to make a direct comparison of the effect of our three methods for obtaining a constant discharge pressure, on the power consumption of the compressor. Inasmuch as we are generally concerned with mass flow rather than volume flow, it becomes necessary to plot our power consumption against this mass flow, from the data calculated and presented in Tables I, V and VI. This comparison is presented in Fig. 5. It becomes apparent immediately that throttling the inlet of a centrifugal compressor is a more favorable means of control than throttling the discharge, but that variable-speed operation is even more satisfactory from the point of view of power consumption. This should not be interpreted to mean that a compressor which will operate at varying mass flows, or which must develop a fixed discharge pressure regardless of inlet temperature variations, should always be operated at variable speed. Generally, if the compressor is turbine driven, variable speed is the correct answer. On the other hand, when a motor-driven installation is contemplated, it may be found that the electrical losses resulting from the use of a variable-speed motor would compensate for the savings to be obtained and that constant-speed operation with varying inlet pressures is preferable.

Wide Range

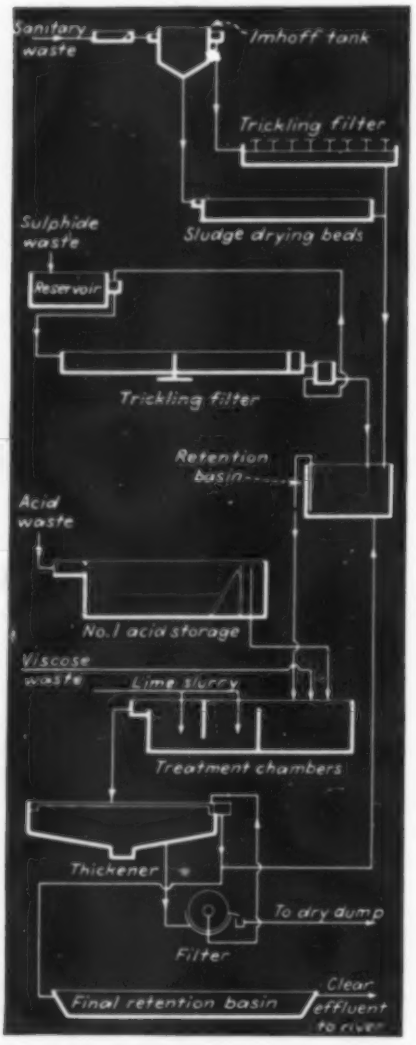
This flexibility of the centrifugal compressor derived from its ability to operate with throttled suction, coupled with the possibility of varying the operating speed, permits the use of a given machine over a very wide range of mass flows and discharge pressures, limited only by the minimum permissible flow for the compressor in question. This minimum flow is controlled in some cases by the maximum permissible operating temperature, which itself depends upon the materials of construction and design characteristics of the compressor in question. In other cases this minimum is determined by the phenomenon of surging or "pumping," as it is commonly known, and by its location in terms of the design capacity of the machine. This location and the severity of the surging will vary for different hydraulic designs. It may be stated, however, as a general average value for both limiting conditions, that operation of centrifugal compressors at volume flows below 50 percent of the design conditions is seldom recommended.

BUILDINGS and 105-ton lime storage bin of the waste treatment plant of American Viscose Corp at Front Royal, Va.



PARSHALL flume of acid-resistant tile measures the wastes from viscose spinning and discharges into 11×11×110-ft. pit

Four Wastes; O



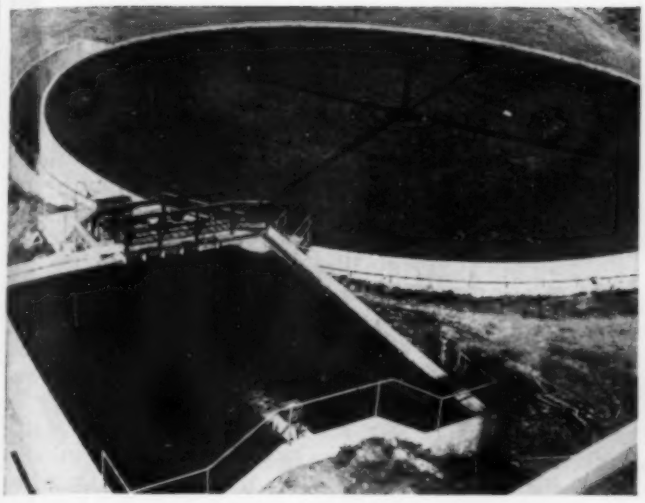
FLOW diagram of Front Royal treatment operations showing how four different industrial wastes are combined and treated to produce an effluent which may with safety be allowed to flow into a river

WASTES treated by the disposal units of the Front Royal plant of the American Viscose Corp. may be divided into four main groups: sanitary sewage, sulphide, alkaline and acid wastes. Sequence in which these occur in the manufacturing process of rayon has little relation to the order of their various treatments once they reach the sewage disposal area. In general, the sanitary sewage is treated in the conventional Imhoff tanks and trickling filters and then mixed with the effluent from a biochemical treatment of the sodium sulphide wastes from the after-treatment of crude rayon. This mixture and alkaline wastes from the department in which the viscose solution is made are added to the flow of acidic wastes from the departments in which the crude rayon is actually spun. Lime slurry is added to this still acidic mixture, resulting sludge removed, and the filtrate resettled before its admission to the river.

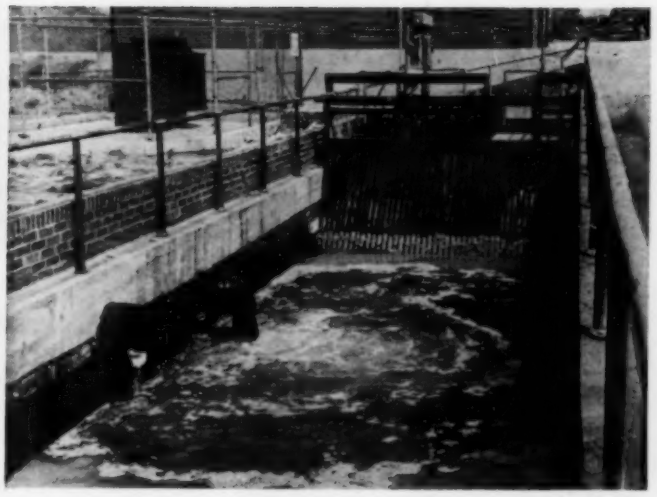
Sanitary Sewage

Treatment of the sanitary sewage from a modern rayon manufacturing plant is handled in much the same way as the treatment of sewage from a small community with a population equal to the employment at the Front Royal plant. The sewage is passed through a coarse bar, galvanized steel screen and then through two Imhoff tanks each of 100,000-gal. capacity connected in parallel. Sludge from these Imhoff tanks is dried on open sludge drying beds which have a total exposure area of 3,600 sq. ft. The effluent, by way of automatic siphons, passes to spray-type trickling filters and then by gravity to a collection

In common with many plants in small communities, that of American Viscose Corp. at Front Royal, has a sewage disposal problem. As in all chemical process industries, industrial wastes from rayon production must be disposed of without creating a public nuisance. The new treatment units not only handle sewage but also the sulphide, alkaline and acid wastes from viscose manufacture and spinning operations.



STORAGE tank and trickling filter of the sulphide unit which lowers color, pH and B.O.D. prior to neutralization



ALKALINE wastes and effluents from sewage and sulphide trickle filters are neutralized in the No. 2 acid storage pit

One Effluent

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HOW ONE VISCOSE PLANT TREATS, MIXES AND DISPOSES OF THE VARIOUS WASTES FROM RAYON PRODUCTION OPERATIONS

basin where it mixes with an effluent from another phase of the waste treatment process.

Sodium Sulphide

In the after treatment of rayon an alkaline sulphide solution is used to desulphurize the yarn. The waste from this operation contains not only some of the original sodium hydroxide and sodium sulphide but also small quantities of various thio compounds. The mixture has a relatively high biochemical oxygen demand—often as much as 200 ppm. The plant for treating this sulphide waste biochemically consists of a 40,000-gal. rectangular concrete storage reservoir equipped with a wooden Parshall flume for measuring the influent, a 2,250 gal. siphon-dosing chamber, a rotary distributor, a circular trickling filter 120 ft. in diameter filled with 6 ft. of trap rock, and a 7,000 gal. filter effluent tank serving as a suction well for two 75 gpm. recirculating pumps. During operation of the waste sulphide treatment unit, the sulphide enters the storage tank as a dark, amber-colored liquid. Its flow is measured and recorded every 2 hr. as it passes through the Parshall flume. At the opposite end of the storage tank are screens which remove solid materials such as yarn and fibers before the sulphide enters the dosing chamber. From here by means of the siphon and distributor it is spread on the trickling filter. As it passes through the trap rock filter, bacteria oxidize the sulphides, polysulphides, etc., to sulphates. The now treated sulphide, which is lower in color, pH and B.O.D., flows into the filter effluent tank from where about 20 percent is returned to the dosing chamber for recirculation. This recirculation is necessary for continuous reseeding of the bed. The remainder of the effluent mixes with the sanitary sewage effluent in the effluent collection basin. This mixture is then pumped to the No. 2 waste acid storage pit where it mixes with the wastes from the departments where the viscose solution is made and spun.

During operation these sulphide treatment units require no attention other than an occasional cleaning of the screens between the storage tank and dosing chamber. After a period of idleness, however, the filter bed must be "reseeded" before use. Well ripened sludge from the Imhoff tanks diluted with water is siphoned to the sulphide filter effluent tank and by way of the recirculating pumps, dosing chamber, and distributor spread on the filter proper. This mixture is recirculated for approximately one week during which time the pH of the system is raised to that of the waste sulphide influent. Waste sulphide is started through the filter and the flow gradually increased until the filter is again under its full load of 1.6 million gallons per acre per day.

Alkaline Wastes

Wastes from the viscose manufacturing department consist of viscose solution itself and various solutions of sodium hydroxide some of which are very high in hemi-cellulose. Since these wastes, as well as some from the rayon finishing departments, are alkaline in nature, they are piped together in the mill from where they flow di-

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SLUDGE of calcium sulphate and suspended solids is removed by filtration

rectly to the No. 2 acid storage pit. Here they are neutralized by the excess acid waste and the mixture then treated.

Acid Wastes

From the spinning departments, where the viscose solution is spun into crude rayon, wastes constitute a flow of several million gallons per day and contain small quantities of sulphuric acid, soluble inorganic salts, thio compounds and organic matter. The flow of these wastes is also measured and automatically recorded in an 18-in. Parshall flume constructed of acid resistant tile. This flume discharges into an acid storage pit 110 ft. long, 11 ft. wide, and 11 ft. deep constructed of acidproof brick laid with an acid-resistant mortar. At the discharge end of the pit a wooden screen catches such solid materials as yarn and fibers. The acid then passes into a second pit—No. 2 acid storage pit—where it mixes with the effluents from the sulphide and sanitary sewage trickle filters and the viscose or alkaline wastes. The sodium hydroxide in the viscose and sulphide wastes neutralizes a portion of the sulphuric acid in the spinning waste and is in turn completely neutralized itself, thus eliminating one more chemical from the list of the untreated and leaving for treatment only those chemicals that are acidic in nature.

Lime

Final treatment—the neutralization of waste acid—is handled by the addition of a lime slurry to the acid and the removal of the resulting calcium sulphate sludge.

Lime is delivered to the plant in covered hopper cars. It is transported by truck from the unloading pit to the lime storage building at the disposal plant. By means of a screw conveyor and bucket elevator it is moved from an unloading pit and stored in a 105-ton capacity steel bin 29 ft. high (including a conical bottom) and 20 ft. in diameter.

Neutralization

In making the neutralization slurry the lime is fed out of the storage bin through a lime feeder and screw conveyor into the lime slaker. A measured amount of water is fed to the slaker and the resulting slurry mixed with an impeller type, motor driven agitator. The slurry overflows into a grit chamber where more water is added and from where undissolved particles of lime, slag, stones, etc., are removed by an eccentric action rake in motion at 8 S.P.M. This grit, raked up a 25 percent incline from the bottom of the chamber to an opening through the building, is dropped into containers for disposal on a dry dump. The lime slurry—10–11 percent CaO—flows into a storage tank where further agitation insures particle distribution and prevents settling. From here the slurry is pumped through automatically controlled valves to the No. 1 acid treatment chamber. This chamber is similar in construction to the acid storage pits except for its capacity which is approximately 16,000 gal. Here the slurry neutralizes that portion of the acid in the mixture of all the liquid wastes and effluents not previously neutralized by the sodium hydroxide in the alkaline wastes.

To insure complete treatment and to obtain thorough mixing the contents of the No. 1 chamber are agitated with a motor driven agitator. A sample of the contents of this chamber is pumped to immersion type electrodes connected to a recording-controlling pH meter. The pH of the acid-lime mixture is recorded and the flow of lime slurry to the acid treatment chamber controlled through automatic operation of the lime feed valve. The apparatus is adjusted to maintain an optimum pH permitting complete neutralization with minimum lime consumption.

The neutralized waste containing calcium sulphate in suspension passes into a second treatment chamber similar in design to the first where more lime can be added, if necessary. Present operation does not demand this, although the agitator in the second chamber is run to maintain the suspension and prevent the settling of calcium sulphate.

With the neutralization of the acidic wastes all that remains is the separation of the calcium sulphate and other suspended solids, which is termed "sludge," from the treated solutions. Since this sludge will settle out of suspension, it is allowed to do just that. The effluent from the second acid treatment chamber flows into a 500,000 gal. rotary thickener. This apparatus is housed in a concrete basin 100 ft. in diameter and varying in depth from approximately 5 ft. near the periphery to 12 ft. at the center. The suspension is fed into the center of the thickener and spread by a rotating, perforated steel distributor. The overflow from the thickener is across a horizontal steel weir located around the full circumference of the basin and into a sloped concrete gutter. As the suspension travels the 50 ft. from distributor to overflow, the solid materials settle to the bottom of the basin from where they are scraped into a sludge pump suction located immediately beneath the screen-distributor. This sludge concentration or scraping is done by rakes of various lengths mounted at approximately 45 deg. on two 50-ft. arms attached to the screen-distributor.

Filtration

A twin cylinder pump moves the sludge from the thickener to a rotary vacuum filter. The filter is 14 ft. long, 11½-ft. in diameter, and is usually run at 12-13 rph. thereby presenting a filtering area of about 6,300 sq. ft. per hr. With a vacuum of 6-7 in. and a filter cake approximately ¼-in. thick the discharged cake averages 15 percent dry solids. This filter cake is dropped through a chute into the suction of a rotary pump and is pumped through a portable steel line to a dry dump.

Filtrate from the rotary filter returns to the thickener overflow gutter where it mixes with the supernatant discharge. These combined flows then pass directly to final retention basins which provide a total storage volume of some 3 million gallons. Since these basins were located a short distance from the river and below the flood level, they are simple earth excavations with no materials of construction involved.

Effluent from the retention basins flows into the Shenandoah River through a sub-surface outfall. An earth and rock jetty forces the treated wastes into the middle of the stream to insure even distribution.

(*Continued from page 131*)

products which is not expressed in the quantitative percentage figures attained.

The low productivity of labor is due apparently to such factors as general disorganization of industries, poor management, high labor turnover, lack of skilled workers, poor geographical distribution of labor, and the general shortage of manpower, somewhat alleviated by military demobilization and by the use of the involuntary labor of an estimated 5 million former Axis soldiers and civilians. The government is trying to meet some of these difficulties with administrative reorganizations, added incentives to labor, and intensified training.

Research Intensified

Emphasis is being placed on more and better training in the 12 institutes of chemical technology as well as in universities, and on intensified scientific research on the part of industries as well as the various chemical branch institutes affiliated with the 200-year-old Russian Academy of Sciences. Russians pointed with pride to the fact that Russian papers reviewed in "Chemical Abstracts" grew from 2.5 percent in 1913 to 14 percent of the total reviewed in 1940. However, recently there are increasing gaps in fields covered in Russian technical and engineering journals—probably for "reasons of military security"—a practice reminiscent of prewar scientific German literature.

Among recent studies reported by Ivan Bardin, vice president of the Academy of Science, are those on the use of oxygen in metallurgical processes, with further studies to be made using blasts of air enriched with varying percentages of oxygen; corrosion research is also being carried out on low allow steels made from naturally alloyed ores found in the USSR. Catalysis in petroleum chemicals is being studied by Nikolai Zelinski. Studies are also being made of synthesis of acetic acid from methanol at superhigh pressures, synthesis of aliphatic compounds on the basis of steam and olefins, and methods for the chemical utilization of methane. Occasional reports on intensified prospecting for new ores and raw materials indicate the country's activity in trying to broaden its raw material base and exploit more of its abundant resources.

Access to resources and production of occupied Europe as far west as the German provinces of the Elbe as well as of Manchuria and northern Korea has been important to the Soviet economy in general and to the chemical industry in particular. This may help in part to explain political actions. Reparations claims and booty have undoubtedly yielded some equipment and supplies, but no official information is available as to the extent.

Non-Russian Resources

Procedures are varying in different areas. Russian gains in Rumania and Hungary, for example, include partial Soviet ownership and virtually complete control of joint companies exploiting these countries' most important resources. Bilateral trade agreements have secured desired materials in Finland, Bulgaria, Yugoslavia, Norway, and Sweden. In this way the Russians hope to concentrate on basic and strategic materials at home and continue to import some specialized and consumer-goods chemicals from neighbors. Collaboration of politically-allied or friendly governments of such countries as Poland and Czechoslovakia has helped the Soviet economy in a similar manner.

In 1946 Poland exported to the Soviet Union 11 million of its 47 million ton coal output, actually more than it could afford. By recent agreement in Moscow this quota was reduced, presumably for 1947-48, by 50 percent. Under another recently-concluded trade agreement, Russia is to supply iron and manganese ores, ferrous alloys, oil derivatives, and chemicals in exchange for Polish glass and non-ferrous metals, chiefly zinc. Czechoslovakia, which like Poland has also nationalized a considerable part of its chemical industry, is collaborating in this field with Russia and recently sent a chemical delegation to Moscow.

Of possibly greater importance than trade with the smaller countries is the assurance of exploitation of chemical industries and raw materials in Soviet-occupied zones of Germany and Austria as long as the Red Army remains there. Former I. G. Farben plants valued at 2,700 million RM are located in the Russian-occupied zone of Germany, as against I. G. plants valued at 2,100 million RM in the combined three western zones. War damage to eastern zone I. G. plants was smaller, amounting to only 254 million RM as against 340 million RM in the western areas. As an example, the Leuna works, largest prewar nitrogen plant in the world and largest German synthetic oil plant, is reportedly in operation again and is making a substantial contribution to the fertilizer supplies of the eastern zone of Germany (and possibly to Russia), and its synthetic oil production is temporarily in progress, with the destination of its products not announced. Two other huge I. G. plants, at Bitterfeld and Wolfen, manufacturing a wide variety of electrochemicals, photochemicals, synthetic fibers, plastics, etc., have been taken over by Soviet corporations and are operated under direct control of the Soviet Military Administration.

Three-quarters of the total capital of newly registered Soviet corporations in the eastern zone of Germany represents Soviet participation in the former I. G. chemical plants at Leuna, Schkopau, Bitterfeld, Wolfen, and Merseburg. These include new Soviet corporations for the rubber industry (capital 500 million rubles), mineral fertilizers (400), alkalis (210), photochemicals (200), dyestuffs (120), plastics (30).

Chemical Exports

Production of plants operating in the Soviet zone of Germany is being taken not only to Russia but is often used as a bargaining weapon on world markets. With control of the German supply added to their own extensive deposits, the Russians, for example, now hold 42 percent of the world's production and trade in potash. They are charging highest possible prices on world markets where hardly any exportable surpluses can be found. Recently the Soviets offered Denmark 100,000 tons of potash in part settlement of a Russian debt; such exports, in general, are being used to obtain sorely needed foreign exchange. The U. S. Military Government is even reported buying potash from the Russian zone of Germany to help supply Korea and Japan.

The Russians are also selling nitrogen on a lesser scale than potash in world markets, again taking advantage of high prices and a short supply. The Soviet Union recently sold some nitrogen to India and has promised some to Czechoslovakia. Thus, the USSR, which in the past has never been an important world trader in chemicals, is now aggressively expanding its domestic production and with the aid of occupied territory resources is actively entering world markets, and will probably be an important competitor to the United States in the future.

THE PLANT NOTEBOOK

Theodore R. Olive, ASSOCIATE EDITOR

December Contest Prize Winner

TWO STAGE CONDENSER SAVES WATER AND SURFACE IN HIGH-STEAM-RATIO STEAM DISTILLATIONS

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OCCASIONALLY it is required to steam distill a water-immiscible solvent from solution with a large quantity of steam in excess of the theoretical minimum requirements. In such a case, the solvent must be recovered and to do so by direct condensation in a surface condenser demands that all the excess steam be first condensed before the constant-boiling mixture will condense as a water-solvent condensate.

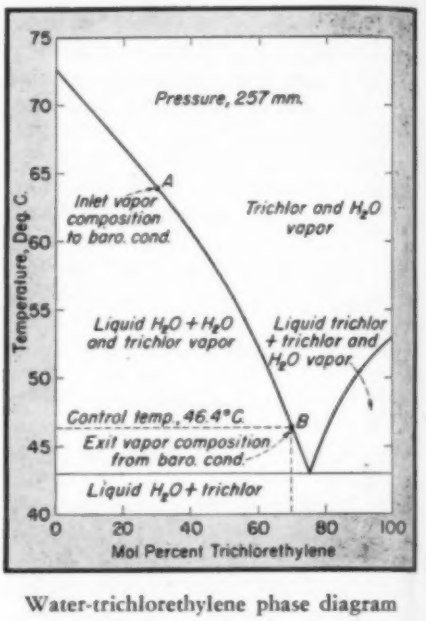
Therefore, a thorough study of the system is justified because the high latent heat required to condense the initial steam requires enormous quantities of cooling water and cooling surface in the surface condenser. A system is here described to adapt a combination of barometric condensation and surface condensation in such a way as to conserve the capital investment and cooling water needed for the surface condensation of water-solvent, and yet condense the initial steam to bring the ratio of steam-solvent vapor to this point.

By first passing the steam-solvent vapor mixture through a barometric condenser, the initial water is condensed and the temperature of the vapor is dropped to a point near the temperature where solvent would start to condense. This condenser uses any cheap water supply and no recovery of condensate is attempted or required. A thermometer is installed in the vapor exit from the barometric condenser which actuates its water supply. Thus, when the temperature tends to drop to a point near that where solvent would start to condense with the water, the water supply is throttled and the temperature again rises to a safe value so no solvent is condensed in the barometric condenser.

On the other hand, since all this steam has been condensed by the barometric condenser and the solvent latent heat is normally only 10 percent that of water, very little surface and cooling water is required for the surface condenser.

This makes the size of necessary decanter smaller than if all the steam were condensed with the solvent. The velocity in the decanter decreases, the settling time increases, all factors favoring a simpler solvent recovery system with lower capital investment.

The accompanying phase diagram illustrates this principle for the trichlorethylene-water system. As the water vapor is condensed from the vapor system, the vapor composition travels from Point A to Point B with a corresponding temperature drop. Point A is the initial vapor condition and Point B is the controlled exit vapor condition from the barometric condenser.



Water-trichlorethylene phase diagram

QUICK METHOD FOR FINDING REYNOLDS NUMBERS

ELBERT M. DeFOREST
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Pittsburg, Kansas

WHENEVER it is necessary to determine a considerable number of Reynolds numbers for the flow of any fluid through a circular pipe, the three tables presented here will greatly expedite the computations.

The Reynolds number $Re = DU\rho/\mu$ is seen to depend on the diameter of the pipe and the velocity of the fluid, as well as on the density and viscosity of the fluid. If the quotient of the last two terms is taken as unity (i.e., water at approximately 70 deg. F.), then the Reynolds number can be expressed in terms of fluid flow rate and pipe diameter alone. Table I gives values of a factor Q/d, where Q is the fluid flow rate in gallons per min. and d is the actual inside diameter of the pipe in inches. It will be observed that this quantity is dimensionally the same as DU in the Reynolds number. Table II lists values of the Reynolds number for values of Q/d from 1.00 to 9.90, which as noted above are valid when $\rho/\mu = 1$. To take care of the fact that this ratio will seldom be unity, Table III provides a correction factor for the Reynolds number obtained from Table II. It represents the quotient of the actual specific gravity of the liquid relative to water at 60 deg. F., divided by its actual viscosity in centipoises.

It should be noted that each of the tables follows through but one

JANUARY WINNER

A $50 prize will be issued to

ALFRED H. McKINNEY
Chemical Engineer
Philadelphia Quartz Co.
Chester, Pa.

Who for the third time is winner of the Plant Notebook Contest. His article describes a handy improvement for gas analysis equipment of the Orsat absorption type.

This article will appear in our March issue. What for it!

cycle of numbers. Higher values are obtained simply by moving the decimal points to the right or left as needed. In Table I moving the decimal point to the right in the flow rate requires a corresponding movement to the right in the value of Q/d. Similarly in Table II moving the decimal point in Q/d requires equal movement in the same direction in the value of the Reynolds number. However, in Table III, moving the decimal point in the viscosity requires an equal but opposite movement of the decimal point in the correction factor (since viscosity is in the denominator of the fraction ρ/μ).

The tables may be interpolated linearly if the desired value of flow rate, viscosity, specific gravity or Q/d falls between the tabulated values. Also, Table I can often be omitted with sufficient accuracy by making a rapid mental calculation of Q/d, employing the nominal pipe diameter. Table I is based on Sch. 40 (standard) iron pipe sizes, but can be used for Sch. 80 (extra heavy) in sizes from 2 to 8 in. by the following adjustments. When figuring for Sch. 80 pipe add the percentages listed below to the flow rate, look up the flow rate thus augmented in the table and read the value of Q/d corresponding to the augmented flow rate. For 2-in. and 2½-in. Sch. 80 pipe add 6½ percent; for 3-in. add 6; for 4- and 5-in. add 5½; and for 8-in. add 4½ percent.

An example will make the use of the tables clear. If the flow rate is 378 g.p.m. through a 4-in. Sch. 40 pipe, the viscosity is 56 centipoises and the specific gravity is 0.95, what is the Reynolds number? What will be the difference for Sch. 80 pipe?

In Table I the nearest value to 378 is 379, giving a Q/d value of 93.7 interpolated (and moving both decimal points one place to the right). From Table II we find that Re corresponding to 93.7 is 269,000 (both decimal points moved one place to the right). Entering Table III at viscosity 56 and interpolating the specific gravity of 0.95, we find the correction factor to be 0.186 (since moving the decimal point two places to the right in viscosity requires moving it two places to the left in the correction factor). Then Re corrected = 269,000 × 0.0186 = 4,990.

Changing to Sch. 80 pipe with all other quantities equal, we multiply the flow of 378 by 105.5 (i.e., add 5½ percent) and thus find Q/d = 99.7, giving Re = 286,000 from Table II, or Re corrected = 286,000 × 0.0186 = 5,320.

$50 CASH PRIZE FOR A GOOD IDEA!

Until further notice the editors of *Chemical Engineering* will award $50 cash each month to the author of the best short article received that month and accepted for publication in the Plant Notebook. The winner each month will be announced in the issue of the next month: e.g., the February winner will be announced in March and his article published in April. Judges will be the editors of *Chemical Engineering*. Non-winning articles submitted for this contest will be published if acceptable at our usual space rates.

Any reader of *Chemical Engineering*, other than a McGraw-Hill employee, may submit as many entries for this contest as he wishes. Acceptable material must be previously unpublished and should be short, preferably not over 300 words, but illustrated if possible. Articles may deal with any sort of plant or production "kink" or shortcut that will be of interest to chemical engineers in the process industries. In addition novel means of presenting useful data, as well as new cost-cutting ideas, are acceptable. Address Plant Notebook Editor, *Chemical Engineering*, 330 West 42nd St., New York 18, N. Y.

Table I—Values of Q/d for Various Flow Rates* in Sch. 40† Pipe From ¼ to 8 In. I.P.S.

	Flow Rate Q, Gal. per Min.—Sch. 40† Pipe Size, Inches I.P.S.										
Q/d	½	¾	1	1¼	1½	2	2½	3	4	6	8
1.00	0.62	0.82	1.05	1.38	1.61	2.07	2.47	3.07	4.03	6.07	7.98
1.10	0.68	0.91	1.15	1.52	1.77	2.27	2.72	3.38	4.43	6.68	8.78
1.20	0.74	0.99	1.26	1.66	1.93	2.48	2.96	3.68	4.83	7.28	9.58
1.30	0.81	1.07	1.36	1.79	2.09	2.69	3.21	3.99	5.24	7.88	10.4
1.40	0.87	1.15	1.47	1.94	2.25	2.89	3.46	4.30	5.64	8.50	11.2
1.50	0.93	1.24	1.58	2.07	2.42	3.10	3.70	4.60	6.04	9.10	12.0
1.60	0.99	1.32	1.68	2.21	2.58	3.31	3.95	4.91	6.44	9.70	12.8
1.70	1.06	1.40	1.79	2.35	2.74	3.51	4.20	5.22	6.85	10.3	13.6
1.80	1.12	1.48	1.89	2.48	2.90	3.72	4.45	5.52	7.25	10.9	14.4
1.90	1.18	1.57	2.00	2.62	3.06	3.92	4.69	5.83	7.65	11.5	15.2
2.00	1.24	1.65	2.10	2.76	3.22	4.14	4.94	6.14	8.06	12.1	16.0
2.10	1.31	1.73	2.20	2.90	3.38	4.35	5.18	6.44	8.46	12.7	16.7
2.20	1.37	1.81	2.31	3.04	3.54	4.55	5.43	6.75	8.86	13.4	17.5
2.30	1.43	1.88	2.41	3.17	3.70	4.76	5.78	7.06	9.27	14.0	18.4
2.40	1.49	1.98	2.52	3.31	3.86	4.97	5.92	7.36	9.67	14.6	19.1
2.50	1.55	2.06	2.62	3.45	4.02	5.17	6.17	7.67	10.0	15.2	19.9
2.60	1.62	2.14	2.73	3.59	4.19	5.38	6.42	7.98	10.5	15.8	20.7
2.70	1.68	2.22	2.84	3.73	4.35	5.58	6.66	8.28	10.9	16.4	21.6
2.80	1.74	2.31	2.94	3.86	4.51	5.80	6.92	8.59	11.3	17.0	22.3
2.90	1.80	2.39	3.04	4.00	4.67	6.00	7.16	8.90	11.7	17.6	23.1
3.00	1.87	2.47	3.15	4.14	4.83	6.21	7.40	9.21	12.1	18.2	23.9
3.10	1.93	2.55	3.25	4.28	4.99	6.42	7.66	9.51	12.5	18.8	24.7
3.20	1.99	2.64	3.36	4.42	5.15	6.62	7.90	9.82	12.9	19.4	25.5
3.30	2.05	2.72	3.46	4.55	5.31	6.83	8.15	10.1	13.3	20.0	26.3
3.40	2.11	2.80	3.57	4.69	5.48	7.04	8.39	10.4	13.7	20.6	27.1
3.50	2.18	2.88	3.68	4.83	5.54	7.24	8.64	10.7	14.1	21.2	27.9
3.60	2.24	2.97	3.78	4.97	5.80	7.45	8.88	11.1	14.5	21.8	28.7
3.70	2.30	3.05	3.88	5.10	5.96	7.66	9.13	11.4	14.9	22.5	29.5
3.80	2.36	3.16	3.99	5.24	6.12	7.86	9.38	11.7	15.3	23.1	30.3
3.90	2.42	3.22	4.09	5.48	6.28	8.07	9.62	12.0	15.7	23.7	31.1
4.00	2.49	3.30	4.20	5.52	6.44	8.28	9.88	12.3	16.1	24.3	31.9
4.10	2.55	3.38	4.30	5.66	6.60	8.48	10.1	12.6	16.5	24.9	32.7
4.20	2.61	3.46	4.41	5.80	6.76	8.69	10.4	12.9	16.9	25.5	33.5
4.30	2.67	3.55	4.51	5.94	6.92	8.90	10.6	13.2	17.3	26.1	34.3
4.40	2.74	3.62	4.62	6.07	7.08	9.10	10.9	13.5	17.7	26.7	35.1
4.50	2.80	3.71	4.73	6.21	7.24	9.31	11.1	13.8	18.1	27.3	35.9
4.60	2.86	3.79	4.83	6.35	7.40	9.52	11.4	14.1	18.5	27.9	36.7
4.70	2.92	3.88	4.94	6.49	7.57	9.73	11.6	14.4	18.9	28.5	37.5
4.80	2.99	3.96	5.04	6.62	7.72	9.93	11.8	14.7	19.3	29.1	38.3
4.90	3.05	4.04	5.14	6.76	7.89	10.1	12.1	15.0	19.7	29.8	39.1
5.00	3.11	4.12	5.25	6.90	8.05	10.4	12.3	15.3	20.2	30.4	39.9
5.10	3.17	4.20	5.36	7.04	8.21	10.6	12.6	15.7	20.6	31.0	40.7
5.20	3.23	4.29	5.46	7.08	8.37	10.8	12.8	16.0	21.0	31.6	41.5
5.30	3.30	4.37	5.56	7.32	8.53	11.0	13.1	16.3	21.4	32.2	42.3
5.40	3.36	4.45	5.67	7.45	8.69	11.2	13.3	16.6	21.8	32.8	43.1
5.50	3.42	4.57	5.77	7.59	8.85	11.4	13.6	16.9	22.2	33.4	43.9
5.60	3.48	4.63	5.88	7.73	9.02	11.6	13.8	17.2	22.6	34.0	44.7
5.70	3.54	4.70	5.98	7.87	9.18	11.8	14.1	17.5	23.0	34.6	45.5
5.80	3.61	4.78	6.08	8.00	9.34	12.0	14.3	17.8	23.4	35.2	46.3
5.90	3.67	4.86	6.19	8.14	9.50	12.2	14.6	18.1	23.8	35.8	47.1
6.00	3.73	4.95	6.30	8.28	9.66	12.4	14.8	18.4	24.2	36.4	47.9
6.10	3.79	5.03	6.40	8.42	9.82	12.6	15.1	18.7	24.6	37.0	48.7
6.20	3.85	5.11	6.51	8.56	9.98	12.8	15.3	19.0	25.0	37.6	49.5
6.30	3.92	5.19	6.62	8.70	10.1	13.0	15.6	19.3	25.4	38.2	50.2
6.40	3.98	5.27	6.72	8.83	10.3	13.2	15.8	19.6	25.8	38.8	51.1
6.50	4.04	5.36	6.82	8.97	10.5	13.5	16.1	19.9	26.2	39.5	51.9
6.60	4.11	5.44	6.93	9.11	10.6	13.7	16.3	20.2	26.6	40.1	52.6
6.70	4.17	5.52	7.04	9.25	10.8	13.9	16.5	20.5	27.0	40.7	53.4
6.80	4.23	5.60	7.14	9.38	11.0	14.1	16.8	20.9	27.4	41.3	54.2
6.90	4.28	5.68	7.24	9.52	11.1	14.3	17.0	21.2	27.8	41.9	55.0

(Table I continued next page)

Table I (Continued)

	Flow Rate Q, Gal. per Min. — Sch. 40† Pipe Size, Inches I.P.S.									
Q/d	½	¾	1	1¼	1½	2	2½	3	4	6	8
7.00	4.35	5.77	7.35	9.66	11.3	14.5	17.3	21.5	28.2	42.5	55.8
7.10	4.42	5.85	7.46	9.80	11.4	14.7	17.5	21.8	28.6	43.1	56.6
7.20	4.48	5.94	7.56	9.94	11.6	14.9	17.8	22.1	29.0	43.7	57.4
7.30	4.54	6.02	7.66	10.1	11.8	15.1	18.0	22.4	29.4	44.3	58.2
7.40	4.60	6.10	7.77	10.2	11.9	15.3	18.3	22.7	29.8	44.9	59.0
7.50	4.66	6.18	7.88	10.4	12.1	15.5	18.5	23.0	30.2	45.5	59.8
7.60	4.73	6.26	7.98	10.5	12.2	15.7	18.8	23.3	30.6	46.1	60.6
7.70	4.79	6.34	8.08	10.6	12.4	15.9	19.0	23.6	31.0	46.7	61.4
7.80	4.85	6.42	8.19	10.8	12.6	16.1	19.3	23.9	31.4	47.4	62.2
7.90	4.92	6.51	8.29	10.9	12.7	16.3	19.5	24.2	31.8	48.0	63.0
8.00	4.98	6.59	8.40	11.0	12.9	16.6	19.8	24.5	32.2	48.6	63.5
8.10	5.04	6.68	8.50	11.2	13.0	16.8	20.0	24.8	32.6	49.2	64.6
8.20	5.10	6.76	8.60	11.3	13.2	17.0	20.3	25.1	33.0	49.8	65.4
8.30	5.16	6.84	8.72	11.5	13.4	17.2	20.5	25.5	33.4	50.4	66.2
8.40	5.22	6.92	8.82	11.6	13.5	17.4	20.7	25.8	33.9	51.0	67.0
8.50	5.29	7.00	8.92	11.7	13.7	17.6	21.0	26.1	34.3	51.6	67.8
8.60	5.35	7.09	9.03	11.9	13.8	17.8	21.2	26.4	34.7	52.2	68.6
8.70	5.41	7.17	9.13	12.0	14.0	18.0	21.5	26.7	35.1	52.8	69.4
8.80	5.47	7.25	9.24	12.1	14.2	18.2	21.7	27.0	35.5	53.4	70.2
8.90	5.54	7.33	9.34	12.3	14.3	18.4	22.0	27.3	35.9	54.0	71.0
9.00	5.60	7.42	9.45	12.4	14.5	18.6	22.2	27.6	36.3	54.6	71.8
9.10	5.66	7.50	9.55	12.6	14.7	18.8	22.5	27.9	36.7	55.2	72.6
9.20	5.72	7.58	9.66	12.7	14.8	19.0	22.7	28.2	37.1	55.8	73.4
9.30	5.78	7.66	9.76	12.8	15.4	19.3	23.0	28.5	37.5	56.4	74.2
9.40	5.84	7.74	9.86	13.0	15.1	19.5	23.2	28.8	37.9	57.0	75.0
9.50	5.91	7.83	9.97	13.1	15.3	19.7	23.5	29.1	38.3	57.6	75.8
9.60	5.97	7.91	10.1	13.2	15.5	19.9	23.7	29.4	38.7	58.2	76.6
9.70	6.03	7.99	10.2	13.4	15.6	20.1	24.0	29.7	39.1	58.8	77.4
9.80	6.10	8.07	10.3	13.5	15.8	20.3	24.2	30.0	39.5	59.4	78.2
9.90	6.16	8.16	10.4	13.7	15.9	20.5	24.4	30.4	39.9	60.1	79.0

* Moving decimal point in flow rate requires same movement in same direction in Q/d.
† See text for Sch. 80 pipe in sizes from 2 to 8 in.

Table II—Reynolds Number Values* for Various Values of Q/d

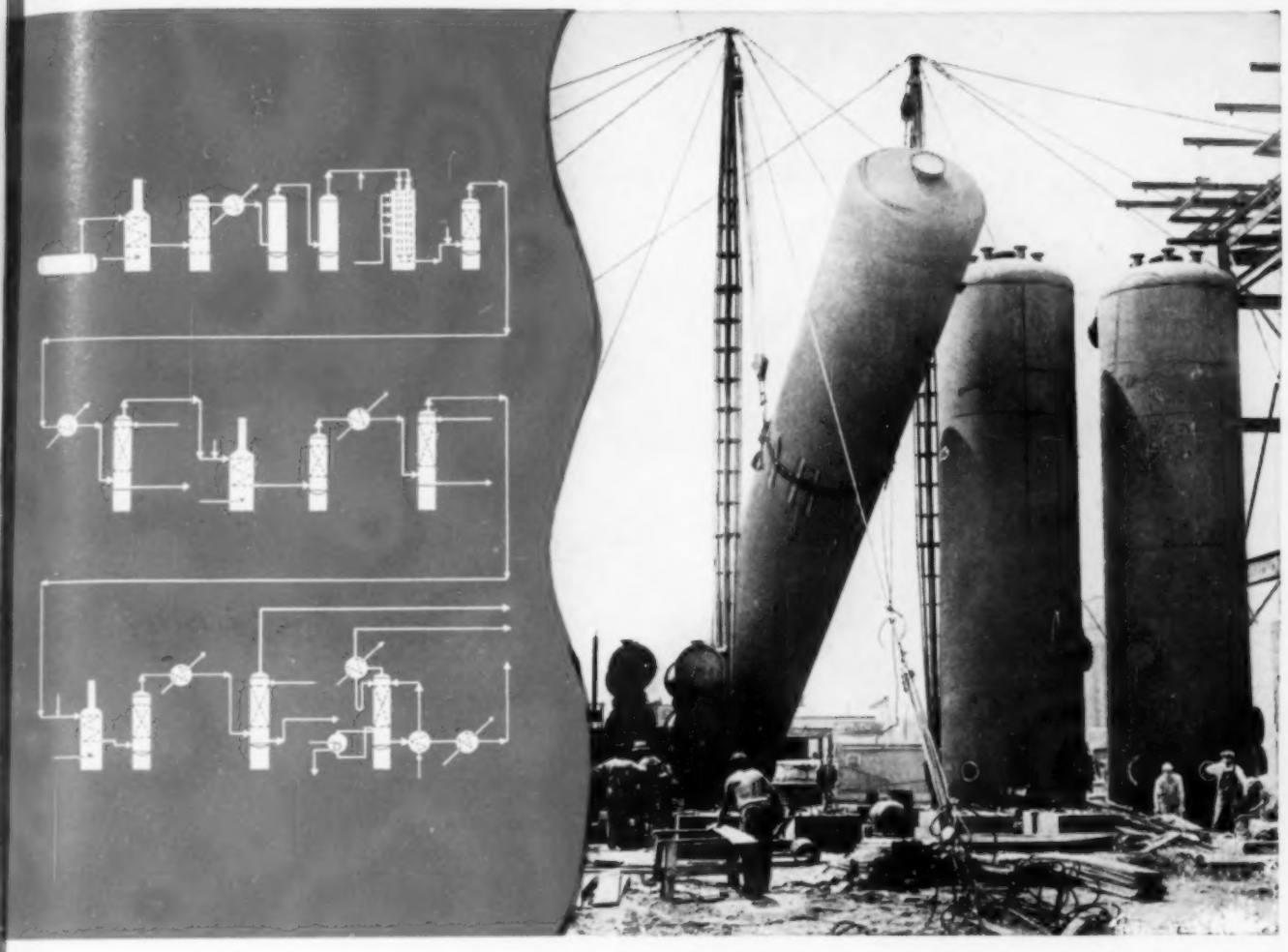
Q/d	Re	Q/d	Re	Q/d	Re
1.00	2,870	3.50	10,000	6.80	19,500
1.05	3,020	3.60	10,300	6.90	19,800
1.10	3,160	3.70	10,600	7.00	20,100
1.15	3,300	3.80	10,900	7.10	20,400
1.20	3,450	3.90	11,200	7.20	20,700
1.25	3,590	4.00	11,500	7.30	21,000
1.30	3,740	4.10	11,800	7.40	21,200
1.35	3,880	4.20	12,100	7.50	21,500
1.40	4,020	4.30	12,400	7.60	21,800
1.45	4,166	4.40	12,600	7.70	22,100
1.50	4,310	4.50	12,900	7.80	22,400
1.55	4,450	4.60	13,200	7.90	22,700
1.60	4,600	4.70	13,500	8.00	23,000
1.65	4,740	4.80	13,800	8.10	23,200
1.70	4,880	4.90	14,000	8.20	23,500
1.75	5,030	5.00	14,400	8.30	23,800
1.80	5,170	5.10	14,700	8.40	24,100
1.90	5,460	5.20	14,900	8.50	24,400
2.00	5,750	5.30	15,200	8.60	24,700
2.10	6,030	5.40	15,500	8.70	25,000
2.20	6,320	5.50	15,800	8.80	25,200
2.30	6,610	5.60	16,100	8.90	25,500
2.40	6,900	5.70	16,400	9.00	25,800
2.50	7,180	5.80	16,700	9.10	26,100
2.60	7,470	5.90	16,900	9.20	26,400
2.70	7,760	6.00	17,200	9.30	26,600
2.80	8,050	6.10	17,500	9.40	27,000
2.90	8,330	6.20	17,800	9.50	27,300
3.00	8,620	6.30	18,100	9.60	27,500
3.10	8,910	6.40	18,400	9.70	27,800
3.20	9,190	6.50	18,700	9.80	28,100
3.30	9,480	6.60	19,000	9.90	28,400
3.40	9,770	6.70	19,200	10.00	28,700

*Moving decimal point in Q/d requires same movement in same direction in Re.

Table III—Factors for Correcting Reynolds Numbers From Table II for Fluid Viscosity and Specific Gravity*

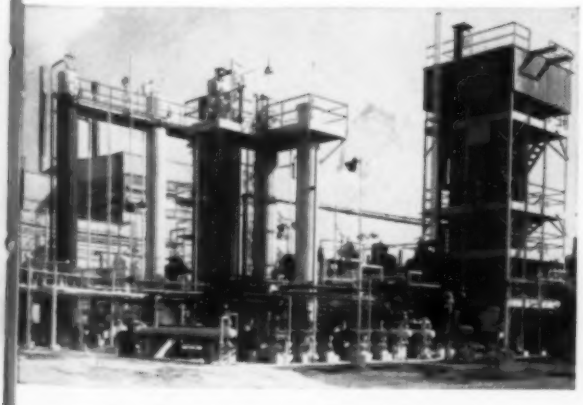
Viscosity, Centipoises	Specific Gravity of Fluid Relative to Water at 60 Deg. F.																		
	0.60	0.70	0.80	0.90	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.2	2.4	2.6	2.8	3.0
0.10	6.60	7.70	8.80	9.90	11.0	12.1	13.2	14.3	15.4	16.5	17.6	18.7	19.8	20.9	22.0	24.2	26.4	27.6	30.8	33.0
0.12	5.50	6.42	7.33	8.25	9.17	10.1	11.0	11.9	12.8	13.8	14.6	15.6	16.5	17.4	18.2	20.2	22.0	23.8	24.6	27.6
0.14	4.71	5.50	6.28	7.07	7.86	8.64	9.42	10.2	11.0	11.8	12.5	13.4	14.1	14.9	15.7	17.3	18.8	20.4	22.0	23.6
0.16	4.13	4.81	5.50	6.19	6.88	7.56	8.26	8.94	9.62	10.3	11.0	11.7	12.3	13.1	13.7	15.1	16.9	17.9	19.2	20.6
0.18	3.67	4.28	4.89	5.50	6.11	6.72	7.33	7.94	8.55	9.16	9.77	10.4	11.0	11.6	12.2	13.4	14.7	15.9	17.1	18.3
0.20	3.30	3.85	4.40	4.95	5.50	6.00	6.60	7.15	7.70	8.25	8.80	9.35	9.90	10.5	11.0	12.1	13.2	14.3	15.4	16.5
0.22	3.00	3.50	4.00	4.50	5.00	5.50	6.00	6.50	7.00	7.50	8.00	8.50	9.00	9.50	10.0	11.0	12.0	13.0	14.0	15.0
0.24	2.75	3.21	3.66	4.12	4.58	5.05	5.50	5.95	6.40	6.90	7.30	7.80	8.25	8.70	9.10	10.1	11.0	11.9	12.3	13.8
0.26	2.54	2.96	3.38	3.81	4.26	4.65	5.10	5.50	5.90	6.35	6.75	7.20	7.60	8.05	8.45	9.30	10.2	11.0	11.8	12.7
0.28	2.35	2.75	3.14	3.53	3.93	4.32	4.71	5.10	5.50	5.90	6.25	6.70	7.05	7.45	7.85	8.65	9.40	10.2	11.0	11.8
0.30	2.20	2.57	2.93	3.30	3.67	4.03	4.40	4.77	5.13	5.50	5.87	6.23	6.60	6.97	7.33	8.07	8.80	9.53	10.3	11.0
0.32	2.06	2.40	2.75	3.09	3.44	3.78	4.13	4.47	4.81	5.15	5.50	5.85	6.15	6.55	6.85	7.55	8.25	8.95	9.60	10.3
0.34	1.94	2.26	2.59	2.91	3.23	3.56	3.88	4.20	4.52	4.85	5.20	5.50	5.80	6.15	6.45	7.20	7.75	8.40	9.05	9.70
0.36	1.89	2.14	2.44	2.75	3.05	3.36	3.66	3.97	4.27	4.58	4.88	5.20	5.50	5.80	6.10	6.70	7.35	7.95	8.55	9.15
0.38	1.73	2.02	2.31	2.61	2.89	3.18	3.47	3.76	4.05	4.34	4.63	4.92	5.20	5.50	5.80	6.35	6.95	7.55	8.10	8.70
0.40	1.65	1.93	2.20	2.48	2.75	3.03	3.30	3.58	3.85	4.13	4.40	4.67	4.95	5.22	5.50	6.05	6.60	7.15	7.70	8.25
0.42	1.57	1.83	2.09	2.35	2.62	2.88	3.14	3.40	3.66	3.92	4.19	4.45	4.71	4.97	5.25	5.75	6.30	6.80	7.35	7.85
0.44	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50	4.75	5.00	5.50	6.00	6.50	7.00	7.50
0.46	1.44	1.67	1.91	2.15	2.39	2.63	2.87	3.11	3.35	3.58	3.82	4.06	4.30	4.54	4.78	5.25	5.75	6.20	6.70	7.20
0.48	1.37	1.60	1.83	2.06	2.29	2.52	2.75	2.97	3.20	3.45	3.65	3.90	4.12	4.35	4.55	5.05	5.50	5.95	6.15	6.90
0.50	1.32	1.54	1.76	1.98	2.20	2.42	2.64	2.86	3.08	3.30	3.49	3.74	3.96	4.18	4.40	4.84	5.30	5.70	6.10	6.60
0.52	1.27	1.48	1.69	1.90	2.13	2.32	2.55	2.75	2.85	3.17	3.37	3.60	3.80	4.02	4.22	4.65	5.10	5.50	5.90	6.35
0.54	1.22	1.42	1.63	1.83	2.04	2.24	2.44	2.65	2.80	3.05	3.26	3.46	3.66	3.87	4.07	4.48	4.88	5.30	5.70	6.10
0.56	1.17	1.37	1.57	1.76	1.96	2.16	2.35	2.55	2.75	2.95	3.14	3.33	3.52	3.72	3.92	4.32	4.70	5.10	5.50	5.90
0.58	1.14	1.33	1.53	1.71	1.89	2.08	2.27	2.46	2.65	2.84	3.03	3.22	3.41	3.60	3.79	4.17	4.55	4.93	5.30	5.70
0.60	1.10	1.28	1.47	1.65	1.83	2.02	2.20	2.38	2.57	2.75	2.93	3.12	3.30	3.48	3.67	4.03	4.40	4.77	5.13	5.50
0.62	1.06	1.24	1.42	1.59	1.78	1.95	2.13	2.31	2.48	2.66	2.84	3.01	3.19	3.37	3.55	3.90	4.27	4.62	4.97	5.30
0.64	1.03	1.20	1.37	1.54	1.72	1.89	2.06	2.23	2.40	2.57	2.75	2.92	3.07	3.27	3.42	3.77	4.12	4.47	4.80	5.14
0.66	1.00	1.16	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.52	2.66	2.83	3.00	3.17	3.33	3.66	4.00	4.33	4.66	5.00
0.68	0.97	1.13	1.29	1.45	1.61	1.78	1.94	2.10	2.26	2.42	2.60	2.75	2.90	3.07	3.22	3.60	3.87	4.20	4.52	4.85
0.70	0.94	1.10	1.26	1.42	1.57	1.73	1.89	2.04	2.20	2.36	2.52	2.67	2.83	2.99	3.14	3.46	3.77	4.09	4.40	4.72
0.72	0.92	1.07	1.22	1.37	1.52	1.68	1.83	1.98	2.13	2.29	2.44	2.60	2.75	2.90	3.05	3.35	3.67	3.97	4.27	4.57
0.74	0.89	1.04	1.19	1.34	1.49	1.64	1.78	1.93	2.08	2.23	2.38	2.53	2.68	2.82	2.97	3.27	3.57	3.87	4.16	4.46
0.76	0.86	1.01	1.15	1.30	1.44	1.59	1.73	1.88	2.02	2.17	2.31	2.46	2.60	2.75	2.90	3.17	3.47	3.77	4.05	4.35
0.78	0.85	0.99	1.13	1.27	1.41	1.55	1.69	1.83	1.98	2.12	2.26	2.40	2.54	2.68	2.82	3.10	3.39	3.67	3.95	4.23
0.80	0.83	0.96	1.10	1.24	1.38	1.51	1.65	1.79	1.93	2.06	2.20	2.34	2.48	2.62	2.75	3.02	3.30	3.57	3.85	4.12
0.85	0.78	0.91	1.04	1.15	1.29	1.42	1.55	1.68	1.81	1.94	2.07	2.20	2.33	2.46	2.59	2.85	3.10	3.37	3.62	3.88
0.90	0.73	0.86	0.98	1.10	1.22	1.35	1.47	1.59	1.71	1.83	1.96	2.08	2.20	2.32	2.44	2.69	2.93	3.18	3.42	3.67
0.95	0.69	0.81	0.93	1.04	1.16	1.27	1.39	1.51	1.62	1.74	1.85	1.97	2.08	2.20	2.32	2.55	2.78	3.01	3.24	3.48

* Moving decimal point in viscosity requires same movement in reverse direction in correction factor.



From Process Flow Diagram through Plant Construction

it's ONE JOB with Girdler®



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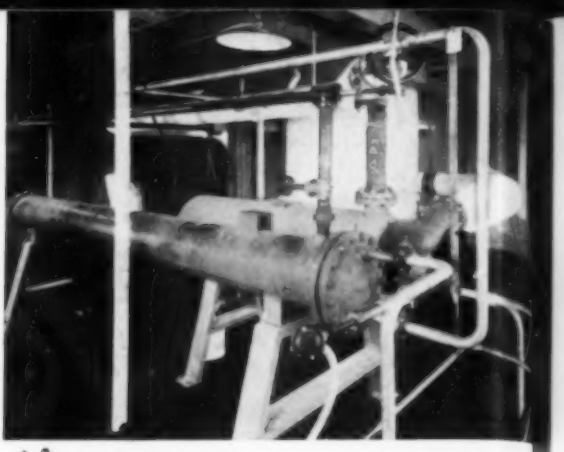
Fatty Acid Distillation



1A Fatty acid charge stock is fed through tub lar preheater (short tube). Feed tower on ri

FATTY acids can be purified and separated by distilling operations. Wilson & Co. is using bulk overhead distillation at its Philadelphia works to produce fatty acid blends, while Armour & Co. has installed a fractional distillation system at its Chicago plant. The equipment for both systems was designed and constructed by Foster Wheeler Corp.

In the Wilson plant the black fatty acid charge stock is fed continuously at 2,500 lb. per hr. through a Dowtherm heated preheater of the tubular type in which the stock temperature is raised to 420 deg. F. Heated fatty acid enters a vaporizing tower where it flows downward over contacting trays countercurrent to the upward flow of superheated steam ejected into the tower base. Unvaporized liquid is recirculated through a second Dowtherm tubular heater in which sufficient sensible heat is supplied to vaporize the remainder of the volatile fatty acid product. Non-volatile pitchy residue is continuously discharged by gravity to a receiver.

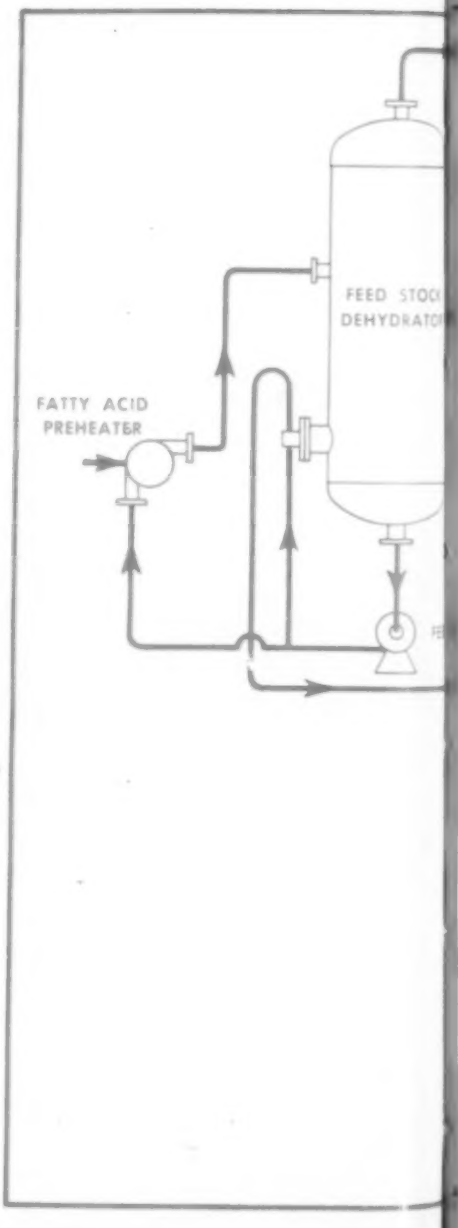
From the top of the tower fatty acid vapors, mixed with stripping steam, pass to a tubular condenser which condenses and removes the distilled acids but permits the accompanying steam to be removed by a three-stage high vacuum unit. Thus, the steam is subsequently condensed in a barometric condenser.

Armour uses three fractionating towers. The first tower receives charge stock of fatty acid preheated in a Dowtherm vapor unit, and produces a small overhead fraction containing a concentration of odor and color-bearing constituents. This distillate passes through a condenser and the condensate returns in part to the tower as reflux while the remainder is withdrawn. A vapor separator ahead of the barometric condenser eliminates entrainment of fatty acids. A moderate vacuum is maintained in the tower.

A liquid side stream containing most of the original charge is piped from the first tower into the main fractionating tower. A high vacuum is maintained at the top of the tower. Overhead distillate, containing remainder of the odor and color-bearing constituents, condenses in a shell and tube unit. Reflux is returned to top of tower as required, while noncondensables are withdrawn. A liquid side stream near top of tower takes off the main fraction, the first fatty acid distillate cut.

The liquid fraction taken from bottom of the main fractionating tower is pumped to a final flash tower. The third overhead distillate, after passing through a condenser, represents the second fatty acid fraction. Noncondensables are removed.

Pitch bottoms of this third tower are pumped to a final stripping tower, the low section of the odor cut tower. This provides a last stripping-out effect so that volatile fatty acids are at a minimum in the residual pitch bottoms drained from this tower.

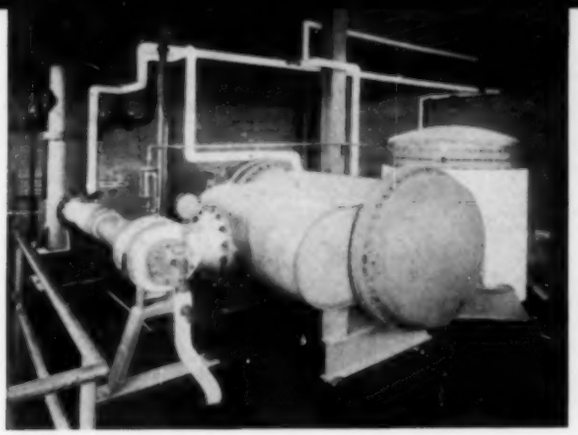


CHEMICAL ENGINEERING

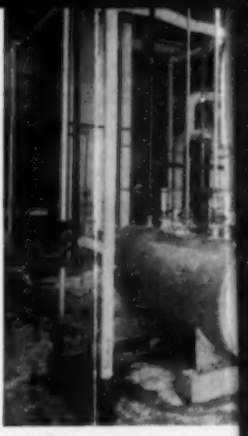
February, 1948

PAGES 146 TO 149

2A Hot acid enters tower and flows down over contacting trays countercurrent to superheated steam

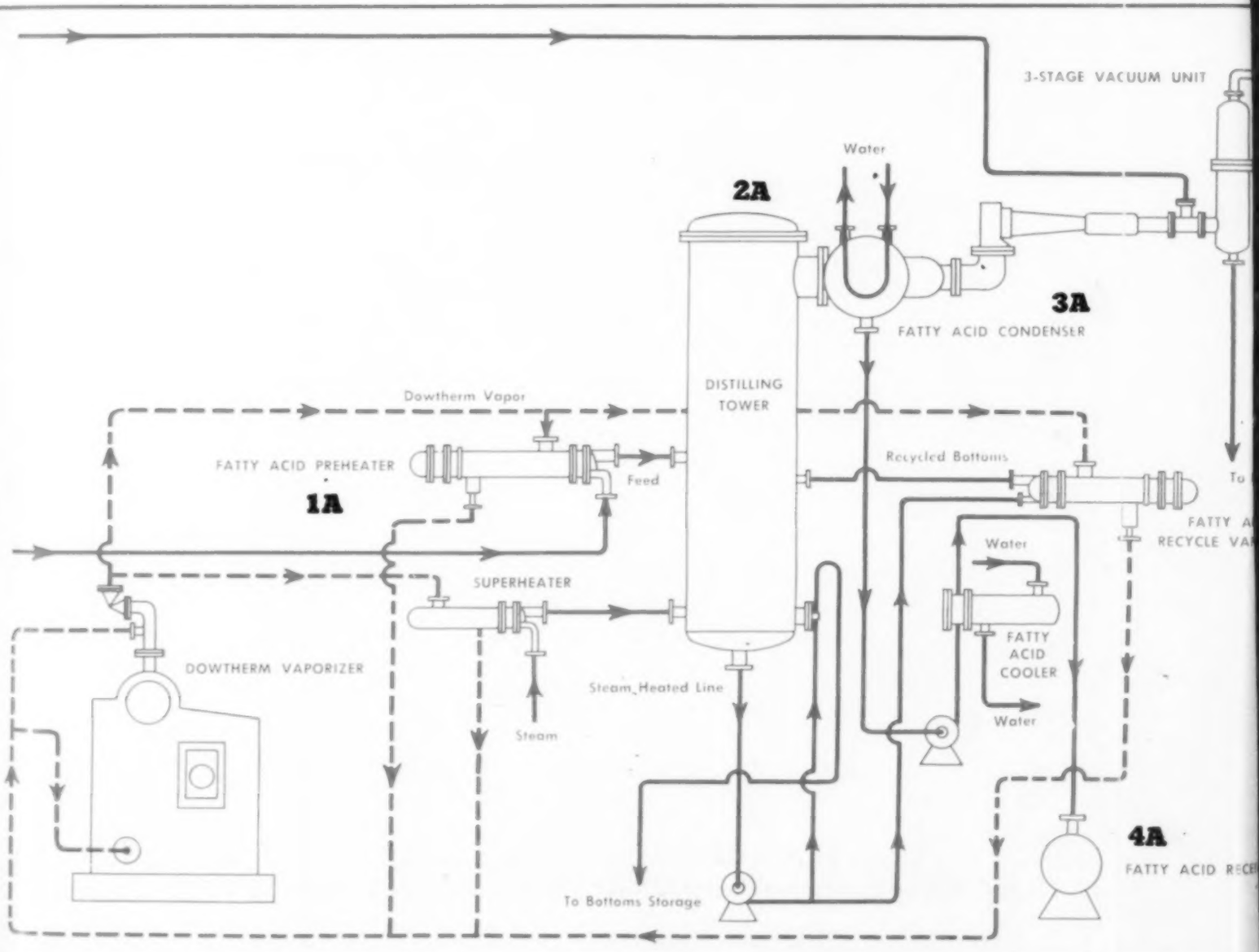


3A Vapors and stripping steam pass to tubular condenser which condenses and removes distilled acids

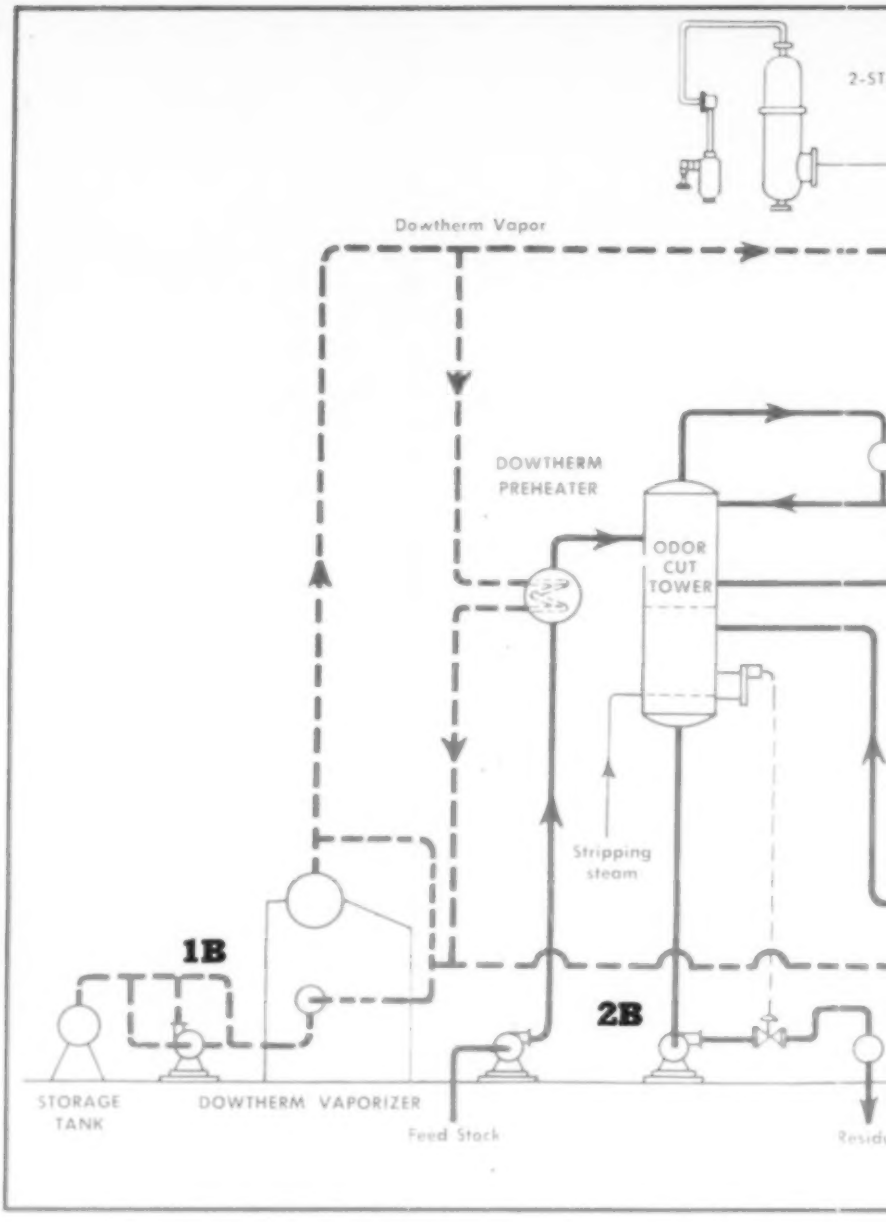


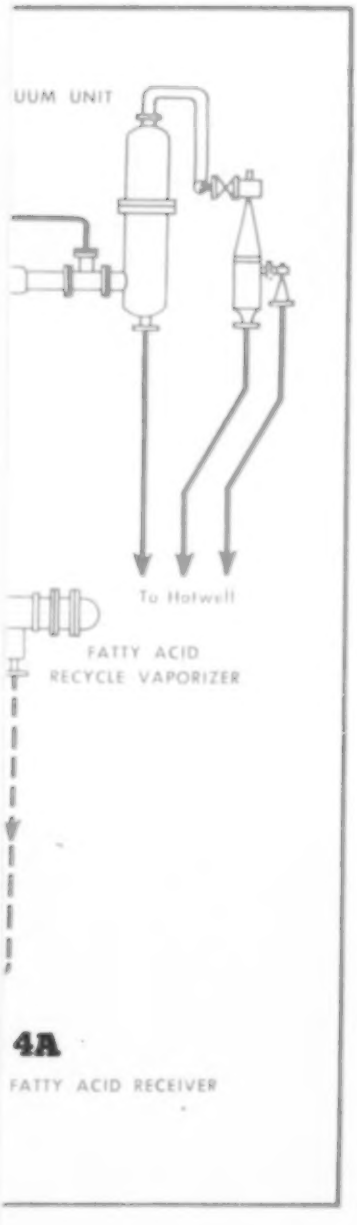
4A Condensed distil
cooler and then pa

STRAIGHT DISTILLATION



ndensed distilled acids are pumped to and then pass to receiver in foreground



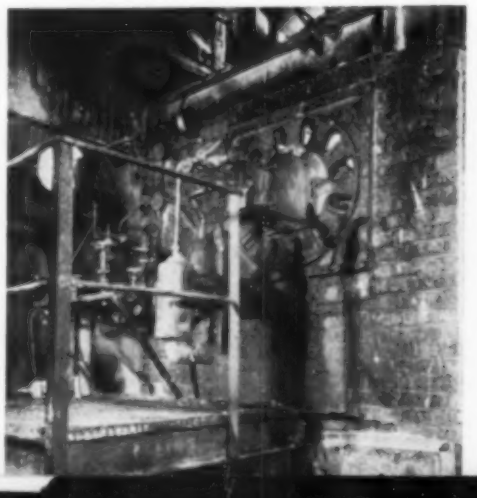


"Chem & Met"

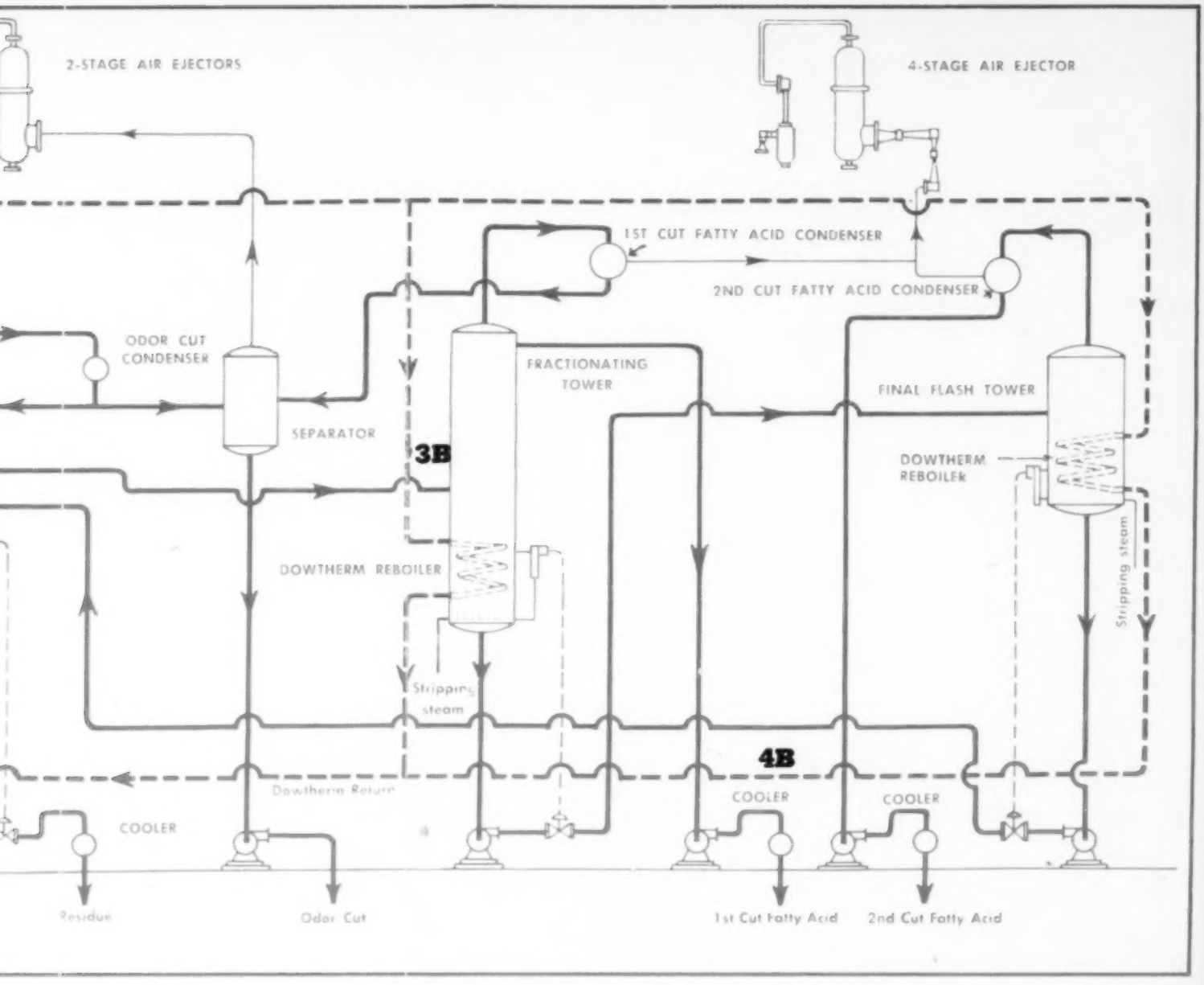
PICTURED FLOWSHEET

FRAC

1B A Dowtherm vaporizer supplies heating medium for processing



2B Fatty acid feed is conveyed to preheat tower by positive displacement pumps



RACTIONAL DISTILLATION

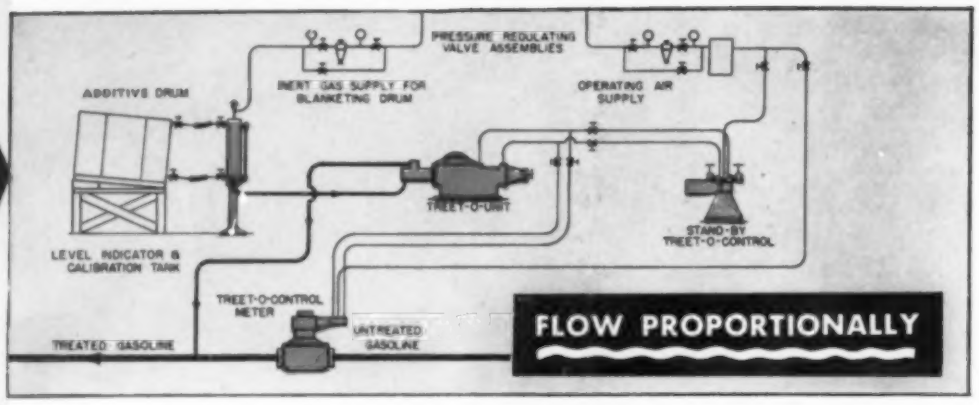
to preheater and odor cut
nps

3B Most of original charge is piped from cut tower to fractionating tower

4B Tower bottoms are recirculated through external heaters by these hot oil pumps

APPLY ADDITIVES *Continuously—Automatically—Accurately*

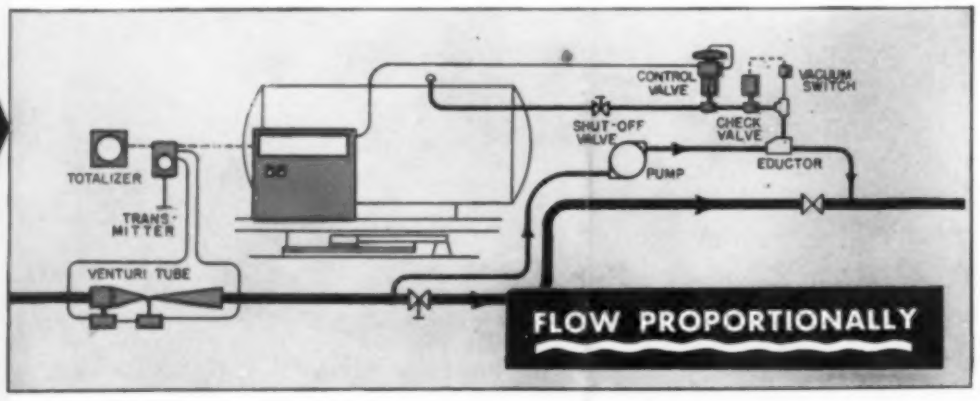
BY VOLUME



All equipment shown red in flowgrams furnished by %Proportioneers, Inc.%

%Proportioneers% Treet-O-Control offers an economical and accurate method of proportioning components or applying additives such as treating agents, inhibitors, lubricants, dyes, etc. Equipment is available for flow rates from 5 to 5,000 G.P.M. and injections of from .0005 to 15 G.P.M.

BY WEIGHT



%Proportioneers% methods permit wide flow variation with sustained accuracy, and additives are applied automatically. As specialists in the field . . . with over 25,000 installations of proportioning equipment . . . we offer engineering advice and the latest equipment for continuous processing and blending—by volume, Bulletin 1200—by weight, Standard Methods 135.

%Proportioneers% "Loss-in-Weight" System is the modern, completely flexible method for continuous process. It automatically maintains pre-set component ratios or permits infinite adjustments in formula or total rate without interrupting the process.

% PROPORTIONEERS, INC. %

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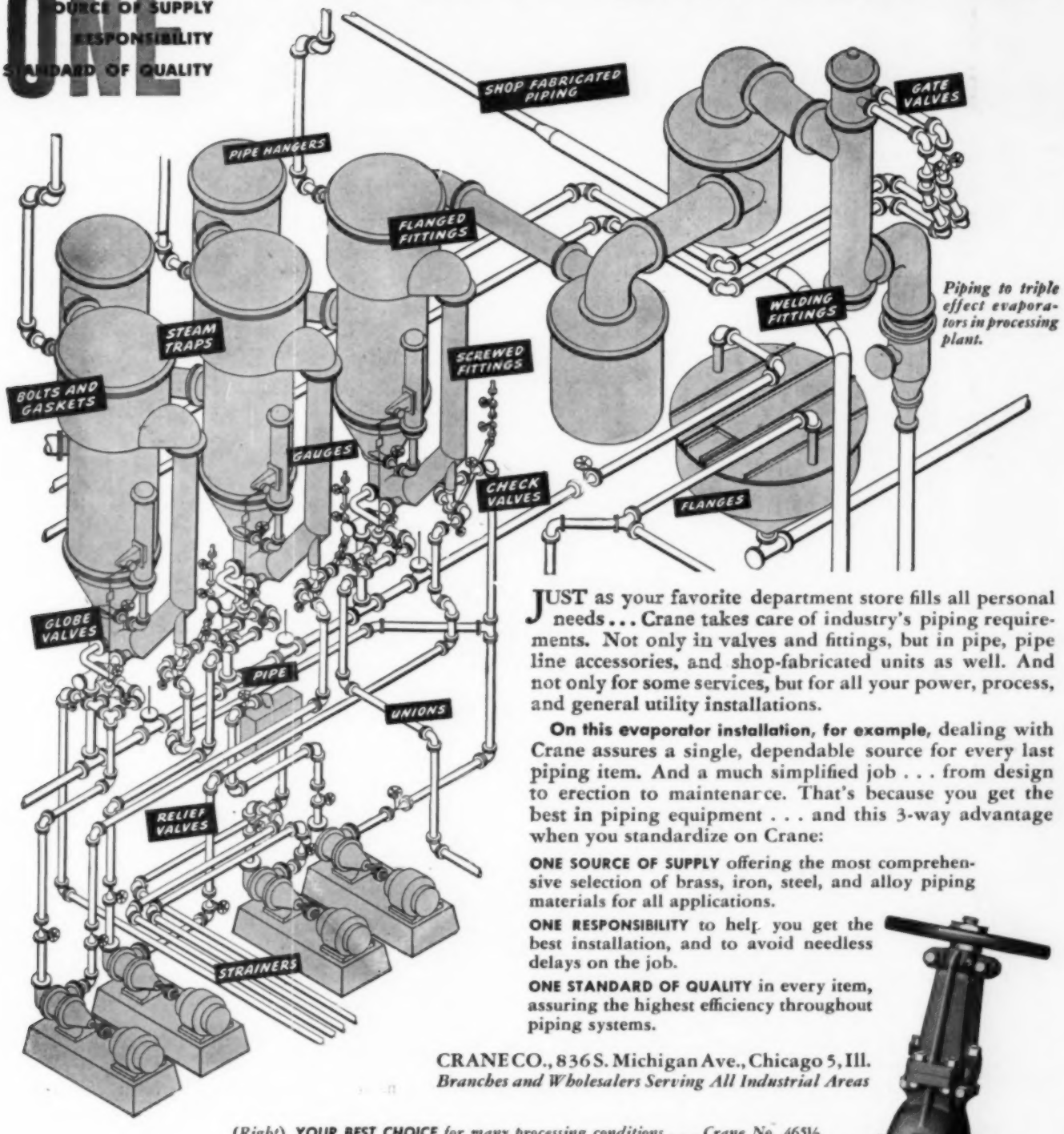
Technical service representatives in principal cities of the United States, Canada, Mexico and other foreign countries.

"Department store" for Piping equipment ... the complete CRANE Line

ONE SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY



Piping to triple effect evaporators in processing plant.

JUST as your favorite department store fills all personal needs ... Crane takes care of industry's piping requirements. Not only in valves and fittings, but in pipe, pipe line accessories, and shop-fabricated units as well. And not only for some services, but for all your power, process, and general utility installations.

On this evaporator installation, for example, dealing with Crane assures a single, dependable source for every last piping item. And a much simplified job ... from design to erection to maintenance. That's because you get the best in piping equipment ... and this 3-way advantage when you standardize on Crane:

ONE SOURCE OF SUPPLY offering the most comprehensive selection of brass, iron, steel, and alloy piping materials for all applications.

ONE RESPONSIBILITY to help you get the best installation, and to avoid needless delays on the job.

ONE STANDARD OF QUALITY in every item, assuring the highest efficiency throughout piping systems.

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(Right) **YOUR BEST CHOICE** *for many processing conditions ... Crane No. 465½ Standard Iron Body Wedge Gate Valves with brass seats and stem. Ideal for wide standardization on steam up to 125 pounds; on water, oil, or gas up to 200 pounds. Non-rising stem and OS&Y types; screwed or flanged ends. Sizes 2 in. and larger. Ask your Crane Man about these valves ... or see your Crane Catalog, p. 101-106*

EVERYTHING FROM ...

VALVES • FITTINGS
PIPE • PLUMBING
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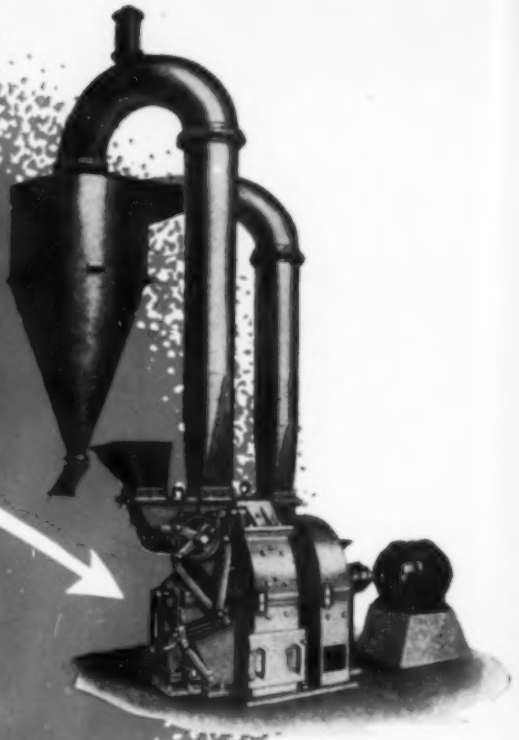
CRANE

FOR EVERY PIPING SYSTEM

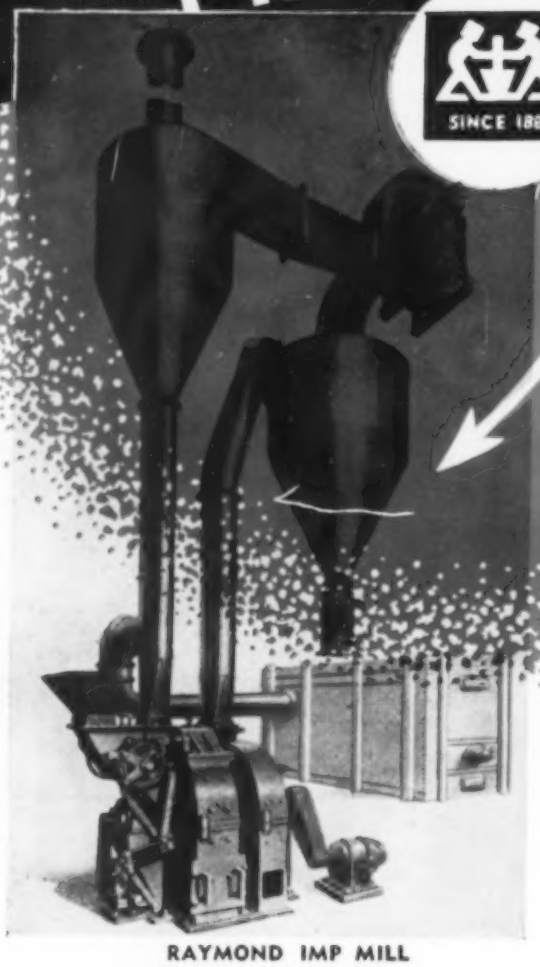
How the...

IMP MILL can solve your GRINDING PROBLEMS

SINCE 1887



Standard IMP MILL with air separation for general grinding.



RAYMOND IMP MILL with Flash Drying System

IMP MILL with Whizzer Separator

Write for Bulletin No. 55, "The Mill of a Thousand Uses."

THE various arrangements of the Raymond Imp Mill, shown above, make it possible to handle many different materials and operations by simple, direct methods that lower the cost of production.

The *standard type* Imp Mill (a), with air separation, covers a wide range of grinding jobs ..... blending aand classifying intimate mixtures ..... making extremely fine and uniform powders in combination with a Mechanical Air Seperator .... or used as a direct-firing unit to pulverize pitch for firing stills, or handling small capacities of coal for industrial furnaces.

The Imp Mill with *flash drying* (b) combines drying and pulverizing in *one* operation. This shortens time of process, eliminates extra equipment and saves floor space. The *whizzer type* Imp Mill (c) provids easy fineness control by changing whizzer speed, and is invaluable in producing superfine products. The whizzer separator (c) can also be incorporated in the flash drying unit (b) to handle three operations: drying, pulverizing and classifying in a single system.

COMBUSTION ENGINEERING COMPANY, INC.

1315 North Branch St., **RAYMOND PULVERIZER DIVISION** Chicago 22, Ill.

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PROCESS EQUIPMENT NEWS

Theodore R. Olive, ASSOCIATE EDITOR

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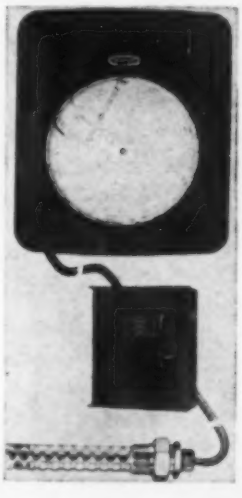
1. Lubricated Plug Valve

SEVERAL NEW design features are incorporated in a lubricated plug valve now being offered by the H. K. Porter Co., Oliver Bldg., Pittsburgh 22, Pa. The design is said to assure complete and leak-proof shut-off, as well as to eliminate leaks through the stuffing box. It is intended particularly for manufactured and natural gas operations, refinery installations and chemical and other processing industries. It is produced in semi-steel, carbon steel, alloy and stainless steels.

2. Dewpoint Recorder

A NEW DEVELOPMENT of the Foxboro Co., Foxboro, Mass., is a dewpoint recorder and recording controller employing an unique measuring element known as the Dewcel. This is a perforated metal cylinder about 9 in. long and 2 in. in diameter, containing a central tube in which is a thermal bulb wrapped in a saline-

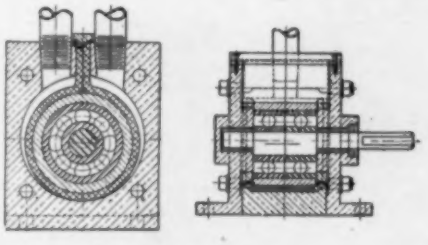


saturated woven glass tape and two windings of silver wire which conduct the heating current. Moisture determination by the Dewcel is based on the fact that for every water vapor pressure in contact with the saturated solution contained in the tape there is an equilibrium temperature at which the solution neither absorbs nor gives up moisture to the atmosphere. The function of the variable heat supply is to bring the Dewcel to this equilibrium temperature. The temperature, measured by the thermal bulb, is transmitted to the recording instrument and is read on the chart in degrees of dewpoint temperature. Two types of instruments are available, an all electronic type and a liquid-filled-system type. Either pneumatic or electric control systems can be used.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 169–170

3. Rotary Pump

A NOVEL type of rotary pump employing a flexible liner and incorporating positive displacement and self-priming features, without the need for a stuffing box, has been announced



by Vanton International Ltd., Empire State Bldg., New York 1, N. Y. The pump is produced in sizes from fractional to 90 g.p.h. As the drawing indicates, it consists of a center housing, a flexible liner, and an eccentric shaft supporting a ball-bearing compression ring. Two pump-end housings contain the shaft bearings and also seal the liner against the center housing. The latter is counterbored so that the liquid can be forced through the pump in the space between the counterbore and the flexible liner by the action of the eccentric which progressively compresses the liner around the housing periphery as the shaft is turned. Construction materials suitable for a wide variety of applications can be provided.

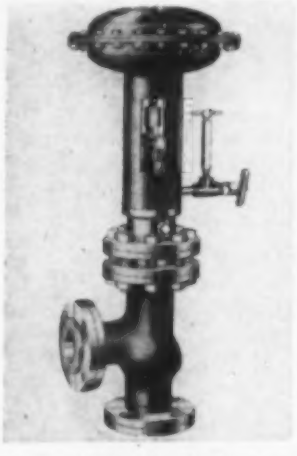
4. Reduced-Area Valves

REDUCED-AREA inner valves are now available for modifying the diaphragm-control valves supplied by the Fisher Governor Co., Marshalltown, Iowa. The manufacturer points out that the use of restricted inner valves in control valves is considered desirable and advantageous under certain circumstances. For example, it may be desired to employ low capacity originally, but to increase the flow through the valve at a later date. Sometimes, also,

valves of too great capacity are initially installed, making it desirable to correct the condition by the use of a restricted type inner valve in the original oversized valve body. Finally, strength requirements may demand a valve of full line size and yet an inner valve one or more sizes smaller may be needed to pass the required flow. Valves may be modified in port area by installing a new inner valve, without changing the seat rings, thus making for a high degree of flexibility in valve sizing.

5. Venturi Control Valves

DESIGNED primarily for high pressure applications, a new line of diaphragm control valves known as Venturiflo has been announced by Hammel-Dahl Co., 243 Richmond St., Providence 3, R. I. The venturi throat used in these valves is said to insure streamline flow characteristics, making

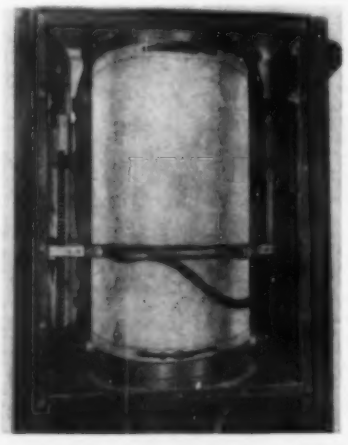


the valve suitable for difficult applications, for example, in fluid catalytic crackers, Fischer-Tropsch plants, etc. The valve incorporates a cast bowl-type angle body said to insure no increase in flow velocity as the fluid leaves the piping and enters the valve body. The seat itself is designed as a section of a venturi throat to give minimum turbulence. Actual capacities with full throat area are said to be 1½ times that of a corresponding conventional control valve. These valves are produced in sizes from ¼ to 8 in., for pressures from 150 to as high as 30,000 psi. and working temperatures from −225 to +1,000 deg. F.

6. Dust Collector

PREVIOUSLY a manufacturer only of fine-grinding machinery, the Pulverizing Machinery Co., 130 Chatham Road, Summit, N. J., has now entered the dust collection field. The new Mikro-Collector is a novel self-cleaning filter employing hard-pressed wool felt as a filter medium for industrial air and gas filtration. Suitable for very fine separation, this medium has previously possessed the disadvantage of easy clogging. The new collector solves this problem, as indicated in the accompanying interior view, by the use of a continuous cleaning device consisting of a hollow, annular blow ring which hugs and flexes the cylindrical felt bag, while moving up and down its surface.

Around the inner periphery of the blow ring is a narrow slit through which a jet of air from a positive pressure blower is supplied. This counter



flow of air is introduced through a flexible hose to the blow ring and "backwashes" the filter material, removing the collected dust from the inner surface and causing it to settle.

This feature is said to give exceptionally high filtration rates and exceptional capacity. The manufacturer claims 99.99 percent minimum recovery of most solids. Actual operation records are said to show filtration rates ranging from a minimum of 8 to a maximum of over 30 cu.ft. of air per min. per sq.ft. of filter surface. The filter is also claimed to be able to handle dust containing a high percentage of moisture or oil. Approximately 35 of the standardized single-bag units are now in regular service and 25 more are on order or being fabricated. Larger installations will employ larger bags or multiple bag units.

7. A.C. Power Source

TO PROVIDE a compact, portable source of variable a.c. voltage, the Superior Electric Co., Bristol, Conn., has introduced the new Type UC1M and UC2M Voltboxes. These devices consist of a cast aluminum case containing a variable transformer, a voltmeter and the necessary output receptacles and binding posts. The device is plugged into a 50/60 cycle single-phase source, producing a continuously adjustable output voltage ranging from 0 to 17 percent above the line voltage at any or all of the output connections. The first type

Cost Indexes for Typical Process Equipment

IN OUR issue of November 1947, pages 124-126, we presented for the first time the Marshall and Stevens indexes for comparative costs of equipment in eight typical process industries and four closely related industries, together with an average index for the 47 different industries, process and non-process, that are regularly covered in this evaluation firm's extensive studies.

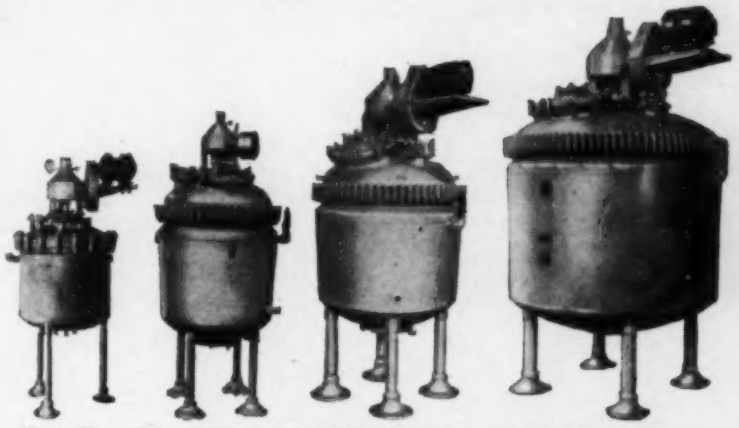
R. W. Stevens, partner of this Chicago and Los Angeles firm, described the methods of obtaining the index numbers in that issue, and listed the indexes back to 1913. At intervals we plan to reprint the complete tabulation from 1913 to current date, while quarterly figures will be published henceforth in our February, May, August and November issues. The quarterly indexes will include: "Year Ago," "Last Quarter," and "This Quarter."

Marshall and Stevens Indexes of Comparative Equipment Costs
(1926 = 100)

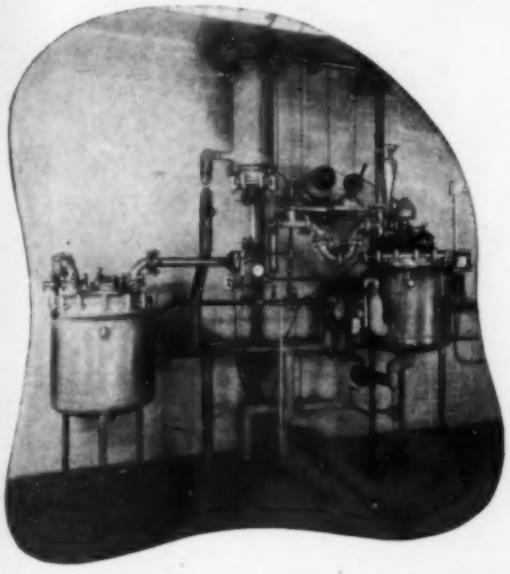
Industry	Dec. 1946	Sept. 1947	Dec. 1947
Average of all	138.5	152.8	155.2
Process Industries			
Cement mfg.	134.5	147.2	148.7
Chemical	141.6	154.2	156.5
Clay products	129.8	142.5	144.6
Glass mfg.	132.4	145.1	146.8
Paint mfg.	136.0	148.7	150.8
Paper mfg.	137.2	149.9	151.4
Petroleum ind.	136.9	149.6	153.0
Rubber ind.	141.4	154.1	155.4
Process ind. avg.	139.2	151.8	154.2
Related Industries			
Elec. power equip.	140.2	152.9	154.3
Mining, milling	143.2	155.9	157.2
Refrigerating	145.0	166.3	168.3
Steam power	131.8	144.5	146.4

How To Get LOW COST Processing Flexibility In Your Pilot Plant or Small-Scale Operations

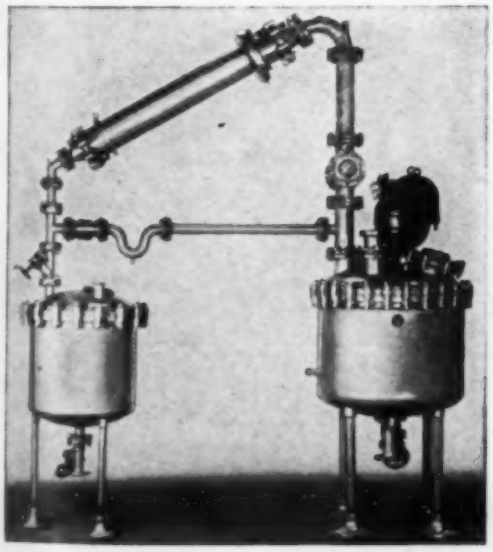
When your plans call for pilot or small-scale operations, you can save money on your equipment investment by utilizing *standard* Pfaudler glass-lined steel or stainless steel reaction equipment. Both types are available in a wide range of sizes with many alternatives with respect to heating jackets, top heads, agitators and drives. Check over the features below. Let us quote on your specific requirements.



Above: Type "P" and "E" Glass-Lined Steel Reactors are made in many sizes to give you maximum selectivity in meeting your problem.



Here is a typical glass-lined steel reaction assembly made up of standard Pfaudler units, including condenser and receiver.



A standard stainless steel assembly for simple distillation.

GLASS-LINED STEEL—5 GALLONS UPWARD

Pfaudler Type "P" (pilot plant) Series of Reactors include open or closed, jacketed or unjacketed, glass-lined steel units of 5, 10, 20, 30, 50 and 100 gallons. Each may be equipped with anchor or impeller glass covered agitators, pulley or motor driven.

Pfaudler Type "E" Series are available with the same alternatives and range from 50 to 750 gallons. Type "ES" are made as standard in 100 gallons capacity (50 and 100 gallons, special); Type "EM," 200 gallons as standard (150 gallons, special); Type "EL," 300 gallons as standard (200 gallons, special); Type "ELL," 500 and 750 gallons. Recent improvements in design have increased actual capacity substantially. Standard jacket pressures have been increased from 75 to 90 psi. Internal pressures are rated at 25, 50 and 100 psi. in all sizes.

All Type "P" and "E" Reactors are lined with Pfaudler glass, resistant to all acids, except hydrofluoric, at elevated temperatures and pressures. This provides maximum processing flexibility. Should your process ever change, it does not involve scrapping the equipment. That may not hold true with metal equipment, an important point to consider when making your selection.

STAINLESS STEEL—5 TO 500 GALLONS

Pfaudler's series of standard Stainless Steel Reactors incorporates the same basic design and operating features as the glass-lined units. Liners are made of all welded stainless steel of types 302, 304, 316, 321 or 347 and in various finishes, with or without heat treatment. They are available with or without carbon steel jackets, welded stainless steel top-heads, stainless steel agitators and pulley or motor drives, etc.

COMPLETELY CATALOGED

Pfaudler Catalogs No. 817 (Glass-Lined Steel) and No. 823 (Stainless Steel) contain complete details from which you can make a selection. If copies are not available, please write and they will be sent. Make your selection of equipment from them. Then ask Pfaudler for a quotation!

Pfaudler

THE PFAUDLER CO., ROCHESTER 4, NEW YORK

ENGINEERS AND FABRICATORS OF CORROSION RESISTANT PROCESS EQUIPMENT

Glass-Lined Steel . . . Stainless Steels . . . Nickel . . . Inconel . . . Monel Metal

mentioned operates on 115 volts and gives an output from 0 to 135 volts, 7.5 amp., while the second type operates on 230 volts, giving an output from 0 to 270 volts, 3.0 amp.

8. Quality Calculator

BENEFITS of sequential sampling can easily be secured through the use of a pocket-size calculator offered by

the Lightning Calculator Co., 496 Atlantic Ave., Brooklyn 17, N. Y. The device can be used by inexperienced operators, telling the operator how many samples to take, how long to continue sampling and, finally, indicating whether the lot should be accepted or rejected. If a plant already uses sequential sampling, the calculator can be calibrated to fit existing standards, or a sequential sampling program may be developed by consulting with a quality control statistician.

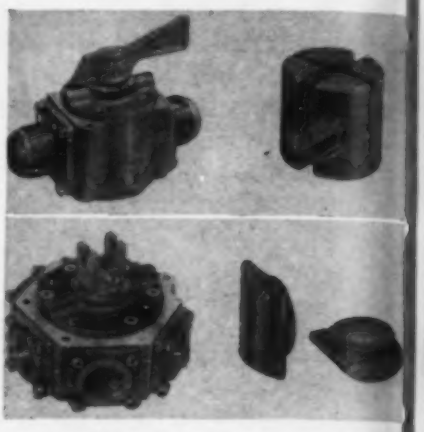
9. Unloading Equipment

Two NEW pieces of materials handling equipment which can be operated as a "team" for the rapid unloading of hopper-bottom freight cars have been announced by the Barber-Greene Co., Aurora, Ill. The car unloader itself, designated as No. 358, has a capacity range up to 3 tons per min., and is a mobile, low-slung belt conveyor with horizontal and elevated portions which can be slipped over the rails and under the hopper openings or can be operated in a rail pit. The material is conveyed from beneath the car and then elevated sufficiently to feed to a new mobile belt elevator, designated as No. 363, which conveys and elevates the material either for stock-piling, or for loading into trucks or other conveying equipment. The No. 358 unloader employs a combination of chain and belt, riveted together, with power transmitted through the chain and belt to give positive belt movement at all times. This equipment is provided with a towing hitch and pneumatic tires and shock absorbers for highway towing. One man can lift it at the tail end to facilitate spotting over rails or in pits. The No. 363 Stockpiler-Loader, also equipped with a towing hitch and pneumatic tires, is available in a belt width of 24 in. and in lengths of 25, 30 and 35 ft. It can be provided with either a gasoline engine or an electric motor.

10. Severe-Service Valves

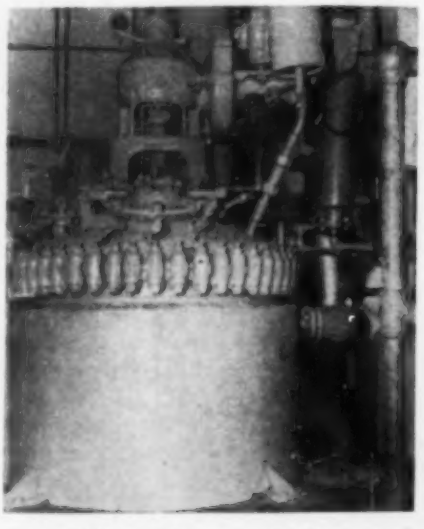
SPECIALLY designed for chemical and process service is a series of non-lubricated selector and shut-off valves announced by the Parker Appliance Co., 17325 Euclid Ave., Cleveland, Ohio. These valves are said to be suitable for handling air, gas, or hot liquids up to 400 deg. F. at non-shock pressures as high as 500 psi. They are available in a variety of metals and are designed to employ non-lubricated rotors of inert graphite. The shut-off valves are constructed around a cylindrical graphite rotor having a central passage at right angles to the cylindrical axis. The construction is indicated in the upper illustration. A 90-deg. rotation either closes the valve or opens it wide.

The selector valves come in a variety of rotor arrangements, permitting the interconnection of various combinations of as many as five separate lines, with an all-off position also provided. An unusual balanced design is employed in which the pressure in a line helps to seal off the



line when the valve is closed. This is accomplished by special graphite inserts fitted into a metallic rotor body at points corresponding to ports which must be sealed. These sealing units are bonded on their inner sides to synthetic rubber sacs containing a light spring. When one of the sealing inserts faces a port, the spring provides initial contact with the valve body area around the port. A hole drilled through the graphite to the inner sac area admits line pressure, thus forcing the insert against the port. The design is suitable for non-shock pressures up to 50 psi. For higher pressures spring loading only is used, without the sac.

The shut-off valve ranges from ¼ to 2 in. and the selector type from ½ to 1¼ in. pipe size.



Silicone Reactor Gasket

Non-adherence to metals, together with retention of original characteristics at temperatures as high as 400 deg. F. and under high vacuum, makes silicone rubber a suitable gasket for chemical reactors, according to the General Electric Co. GE has been employing such gaskets for many months in the manufacture of Glyptal alkyd resins. This material is said to provide excellent resistance to alcohol, phenol, aromatic hydrocarbons and other solvents. It is said to be effective as a gasket material since it requires no plasticizer which might be lost under operating conditions.

11. Cushion Idler

FOR USE AT loading points under belt conveyors, the Goodyear Tire & Rubber Co., Akron, Ohio, has developed a new type of impact-cushioning idler which supplements this company's previous application of pneumatic tires beneath belts to absorb the shock of falling material. The new cushion-type idlers are non-pneumatic, consisting of rubber rings mounted on the idler core, instead of the conventional rubber-covered steel idler. Compared with the latter, the

The manufacture of pharmaceuticals has advanced rapidly, and with the development of such drugs as penicillin, the industry has contributed much to the progress of medical science. In the manufacture of penicillin, Victor* Phosphoric Acid plays a vital role in the recovery of the raw product from the harvest liquor. Victor Phosphorus Oxychloride serves as a chlorinating agent in the processing of sulfa drugs. Phosphorus Oxychloride is also employed in one of the steps in the synthesis of atabrin, the anti-malarial specific.

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Victor chemicals used in the manufacture of pharmaceuticals include:

Dicalcium Phosphate . . . mineral supplement, dentifrice polishing agent.

Phosphorus Chlorides . . . intermediates, chlorinating agents in organic synthesis.

Tricalcium Phosphate . . . dentifrice polishing agent, antacid, dusting of pills, mineral supplement.

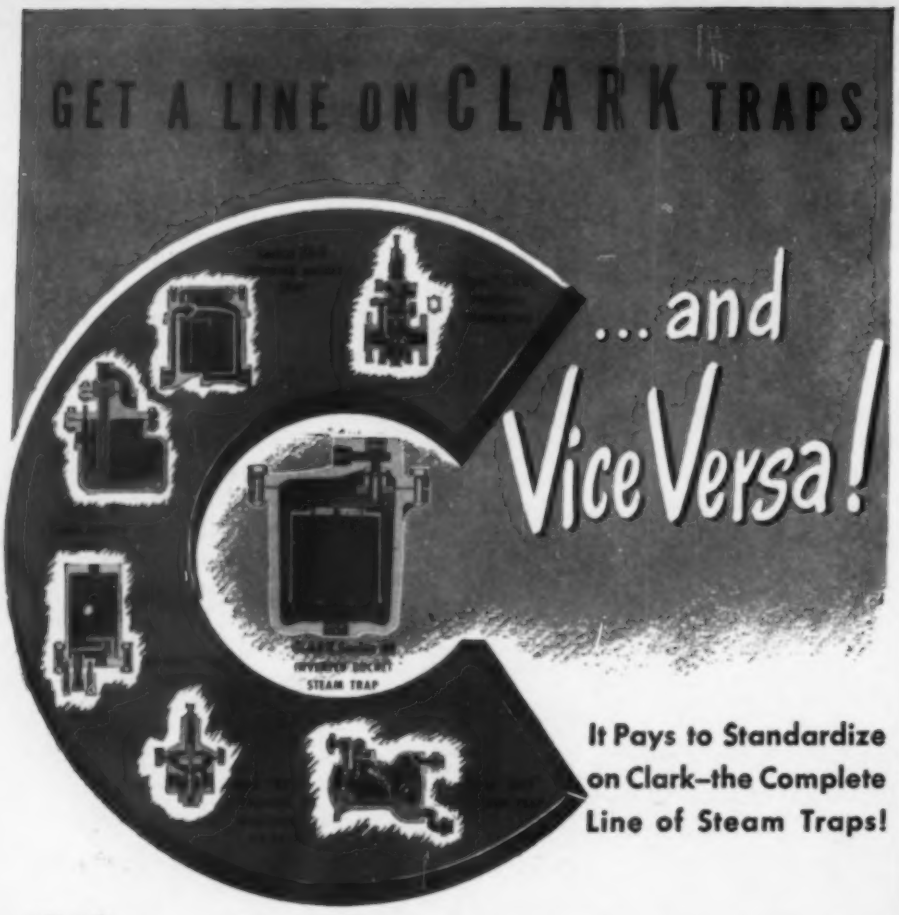
Iron Phosphates . . . mineral supplement.

Aluminum Phosphates . . . astringents, acidulants.

Phosphoric Acid . . . chemical reagent, acidulant.

Potassium and **Sodium Phosphates** . . . medicinals.

VICTOR CHEMICAL WORKS, 141 West Jackson Boulevard, Chicago 4, Illinois



It Pays to Standardize on Clark–the Complete Line of Steam Traps!

40 YEARS OF EXPERIENCE PROVE THAT CLARK CONTROLS

Last Longer
Cut Maintenance Costs
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If your production costs have been going up (and whose haven't) Clark can help you "hold the price line." The Heavier, Stronger construction of CLARK Controls makes for longer life and less frequent replacement. Our Engineering Department stands ready to help you on all fluid control problems.

Write today for details.

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Clark
FLUID CONTROLS

FOR MORE INFORMATION
See Reader Service Coupon on pages 169–170

maximum deflection is about six times greater. This is said to result in material increase in life of the belt, sometimes doubling it. The new idler is intended for less severe application than those employing the pneumatic tires, which are still used for the most difficult cases.

12. Portable Conveyor

To FACILITATE loading and stacking operations the Rapids-Standard Co., Grand Rapids, Mich., has introduced a new small power-driven belt con-

veyor known as the Stevedore, Jr. Features include interchangeable head and tail sections, non-impaling guard rails, one-piece channel construction, and crank adjustment from horizontal to 28 deg. incline. The device can be used as a horizontal conveyor, stacker or booster in a gravity conveyor line.

13. Jar Tumbler

NEWLY added to the family of Tumble-Jars manufactured by Andrew Technical Service, 111 East Delaware Place, Chicago, Ill., is a new 6-in. diameter by 8-in. high model. The tumbler, which can also be used as a ball mill, consists of a glazed chemical

HYDRAULIC PRESSES DESIGNED to fit into your production plans

Here are three examples of the thousands of hydraulic presses we have designed and built for "putting the squeeze" on rubber, plastics, linoleum, tiling, and other materials.

F-B presses range from 12" square for small mold work up to any size required for molding large plastic sections, and for vulcanizing rubber belts, floor tiling, etc. Design and materials provide the strength required for minimum deflection.

They can be made for any pressure and equipped with controls for fully automatic cycle operation or for semi-automatic or manual operation. Presses are equipped with individual pumping unit, integral with the press or mounted separately; or arranged for group operation from central pump and accumulator system.

Tell us your problem and ask for information and estimates on presses for your specific requirements.

24" x 42" press with four 3" openings, 12" stroke, and 597 tons capacity with 2250 lbs. working pressure on the 26" diameter ram. Designed for use with a pump and accumulator system operating a number of presses.

42" x 42" press with four 4" openings, 16" stroke, and 531 tons capacity with 2,000 lbs. working pressure on the 26" diameter ram. Equipped with individual oil power unit and hydraulic lift table.

24" x 24" press, having two 4" openings, 8" stroke, and a capacity of 177 tons with 2,000 lbs. working pressure on the 15" diameter ram. Equipped with individual oil power unit.

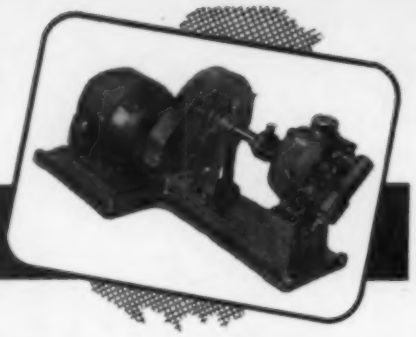
FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Pittsburgh, Akron, Chicago, Los Angeles, Tulsa, Houston.

Farrel-Birmingham

FB-418

It Pays to Know GENUINE VIKING PUMPS



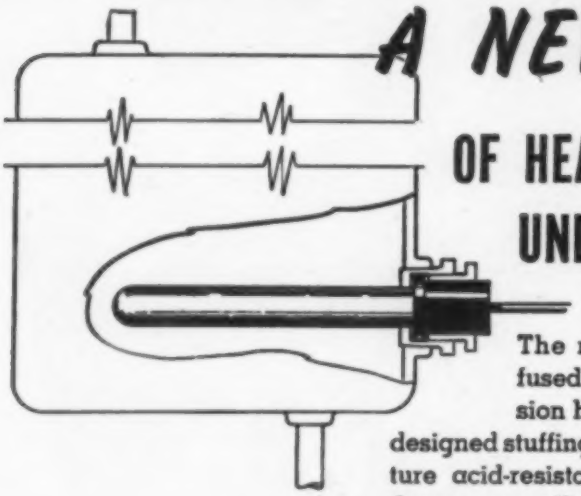
Know genuine Viking pumps and what they will do for you. They are the original in the rotary "gear within a gear" principle . . . the leader in the industry.

Remember, please, that Vikings are engineered for your job . . . they are ruggedly constructed, with no small, intricate parts or timing gears to get out of order. Vikings mean long, trouble-free pumping service. Look for the registered Viking trademark or name on every genuine Viking pump. These are your guarantee of Viking superiority.

Be sure, when you buy, that the pumps you get are genuine Vikings. Write and tell us about your pumping problem. Ask for Bulletin Series 47SC. It will be sent free immediately.

See Our Catalog In SWEETS

Viking PUMP COMPANY
Cedar Falls, Iowa



A NEW WAY OF HEATING LIQUIDS UNDER PRESSURE

The new Amersil* opaque fused quartz electric immersion heater, with its specially designed stuffing box, and high temperature acid-resistant resilient head, produces new efficiency standards when heating liquids under pressure.

In vessels or tanks limited in size, the heater occupies a minimum of space within the liquid or gas area. It provides accurate control over a wide temperature range.

Write today to Dept. "CE" for new bulletin on Amersil heaters.

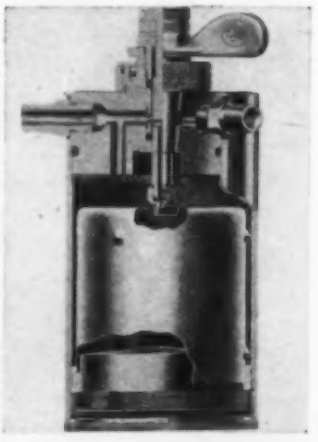
*Trade Name Registered

AMERSIL COMPANY Inc.
ENGELHARD
CHESTNUT AVENUE HILLSIDE 5, N. J.

stoneware cover, fitting tightly against a soft rubber gasket by means of a metal clamp. The unit is said to be applicable both in small-scale industrial operations, as well as in research and pilot plant operations in blending, mixing, dispersion and the making of emulsions and colloids. Both liquids and solids can be handled.

14. Automatic Pressure Controller

FOR THE automatic regulation of pressure and vacuum, Emil Greiner Co., 161 Sixth Ave., New York, N. Y., has introduced a new regulator operating on the principal of the Cartesian diver. Known as the industrial Cartesian Manostat, Model 5, the device is completely self-contained and needs only to be put into an existing system and set to maintain the desired pressure or vacuum. It then requires no further attention. It is claimed that the desired absolute pressure will be maintained to within ½ of 1 percent. Made of metal, the device operates on the same general principal as the laboratory glass Manostat recently introduced by this manufacturer.



15. Ceramic Pipe Joint

A FLEXIBLE rubber joint of novel design for use with plain-end ceramic pipe has been announced by Joints, Inc., 2030 Venice Blvd., Los Angeles, Calif. This joint was designed pri-

CHOOSE GE TURBINE DRIVE

...FOR COMPLETE SERVICE

FAST SHIPMENT

Here's good news for power-hungry plants! Delivery time on our standard (single-stage, shaft-governed) mechanical-drive turbines is down to approximately 15 weeks. Thanks to standardization and new plant facilities, shipment of standard units is better than ever before.

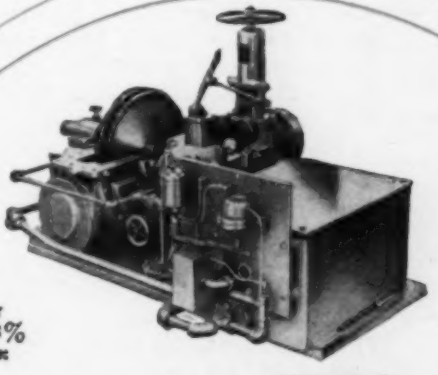
APPLICATION ASSISTANCE

G-E turbines can do a multitude of jobs—driving pumps, compressors, fans, blowers, processing machines. General Electric application engineers, backed by the experience of the world's largest turbine manufacturer, are ready to assist you in applying the *right* turbine to the *right* job.

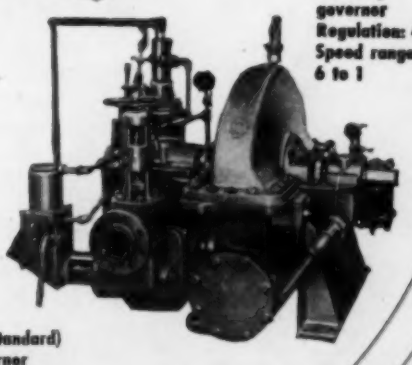
QUICK SERVICE

You can get service in a hurry when you operate G-E turbine drive. G-E maintains 26 service shops and 115 sales offices, located throughout the country. You can call on them for quick and convenient aid.

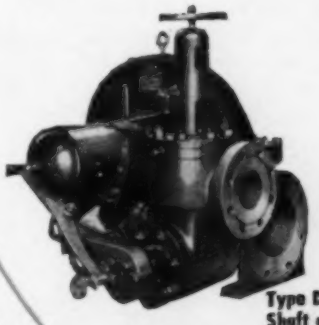
If your plant needs more horsepower, you can put G-E's complete service to work for you. Get in touch with the nearest G-E Sales Office, or write Apparatus Department, General Electric Co., Schenectady 5, N. Y.



Type DO
Oil governor
Regulation 8%
Speed Range: 5 to 1



Type DOR
Oil-relay governor
Regulation: 4%
Speed range: 6 to 1



Type DS (standard)
Shaft governor
Regulation: 8%
Speed range: 1.1 to 1

WRITE TODAY FOR THIS NEW BULLETIN!

We'll be glad to send you the new 24-page bulletin GEA-4845, describing the features and application of Type DOR turbines. Just write General Electric Co., Dept. 252-24, Schenectady 5, New York.

A *COMPLETE* LINE

Single- and multi-stage, direct-connected and geared

GENERAL ELECTRIC

252-24

18-8

AND THE ODDS ARE

...3 TO 1....

THE odds are 3 to 1 that castings made from one of the famous Circle ① "18 and 8" alloys will do a better and more practical job in resisting corrosive conditions than those made from any other formula.

We pour a lot of alloy tonnage out of our electric induction furnaces in the course of a month. Some of it is very special stuff. All of it is carefully matched to the exact service conditions of the equipment and machinery into which the castings are fabricated. A study of our records proves beyond a doubt that our Circle ① "family" of "18 and 8" alloys tops the list as the practical, economical corrosion resistant material.

The Nominal Analysis and Nominal Physical Properties of one of these, Circle ① 22, are given at left. However there are many variants of this approximate analysis which make possible its successful application to a wide range of service conditions. They are summarized on the new Circle ① Alloy Data Sheet, sent upon request.

LEBANON CIRCLE ① 22

NOMINAL ANALYSIS

Carbon Max.	0.07
Silicon	1.25
Manganese	0.75
Chromium	19.50
Nickel	9.00

NOMINAL PHYSICAL PROPERTIES

Tensile Strength	75,000
Yield Point	36,000
Elongation in 2"—%	50
Brinell Hardness	135

LEBANON STEEL FOUNDRY, LEBANON, PA.
"In The Lebanon Valley"

ORIGINAL AMERICAN LICENSEE GEORGE FISCHER (SWISS CHAMOTTE) METHOD

LEBANON ALLOY AND STEEL Castings

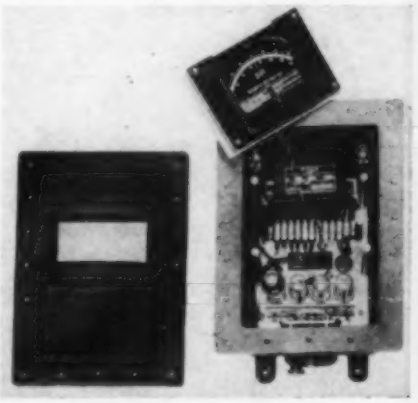
CIRCLE ①

FOR MORE INFORMATION
See Reader Service Coupon on pages 169–170

marily for use with Ceramicweld pipe, a product of Pacific Clay Products Co., of Los Angeles. The joint consists of a synthetic rubber coupling, which is clamped on the ends of the pipe by means of two stainless steel straps. The coupling is then encased in either concrete or a hotmelt compound, retained by a composition cover. These joints are regularily employed in chemical and sewer lines for pressures up to 35 psi., while special joints are available for pressures up to 200 psi. Owing to the flexibility of the joint, deflections of as much as 2½ in. in a 5 ft. length are said not to cause leakage or rupture.

16. Improved pH Meter

FOR USE in chemical and petroleum plant applications, in Class 1, Group D hazardous atmospheres, the Macbeth Corp., 227 West 17th St., New York 11, N. Y., has introduced a new explosion-proof, line-operated direct-



reading, continuous-indicating pH meter. Designed as an indicator, the instrument is provided with a connection for operating a recorder at a remote location. As the accompanying illustration shows, the instrument is housed in a heavily constructed case of broad-flange design to impart explosion-proof characteristics, for use in atmospheres containing gasoline, petroleum, ethyl alcohol and acetone.

17. Expansion Joint

ANY KIND of movement in high-temperature pipelines—axial, lateral, or angular, or any combination of these—can be handled with a new line of universal expansion joints

CELANESE* FORMALDEHYDE

Formaldehyde is one of the most important products in the expanding family of organic chemicals produced at CHEMCEL, the Celanese plant near Bishop, Texas.

High quality Celanese Formaldehyde U.S.P. is sold commercially as Formalin—a water white solution containing 40% Formaldehyde by volume, 37% by weight. It is manufactured in both methanol inhibited and uninhibited grades.

A clear, colorless liquid, controlled to meet the most exacting requirements, Celanese Formaldehyde is widely used in resins, adhesives, plastics and in the production of various organic chemicals.

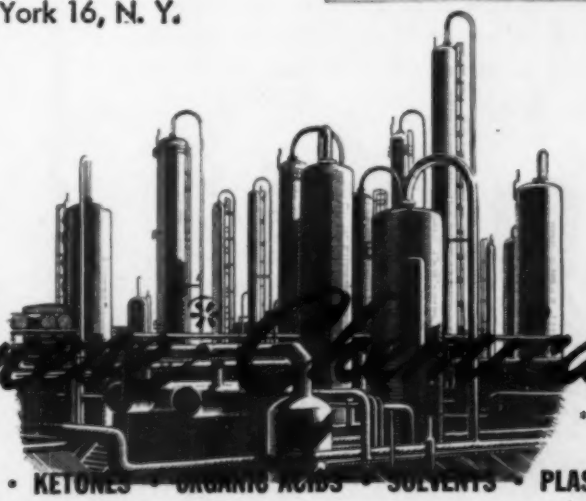
A new brochure is available containing specifications and general information on many of the Celanese organic chemicals. Write for your copy—and call on Celanese whenever you need technical assistance regarding organics.

CELANESE CORPORATION OF AMERICA
Chemical Division
180 Madison Avenue, New York 16, N. Y.

CELANESE*

iso-Propyl Alcohol

Celanese iso-Propyl Alcohol, produced in tank car quantities, is a Technical Grade alcohol possessing an exceptionally pleasant odor. This unusual characteristic suggests wide application as a chemical intermediate, solvent, extractant, diluent and for conversion to its respective esters. In addition, its low freezing point characteristics have fully established its use as an anti-freeze.



Celanese Chemicals

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ALCOHOLS • ALDEHYDES • GLYCOLS • KETONES • ORGANIC ACIDS • SOLVENTS • PLASTICIZERS • INTERMEDIATES

Complete *Your* process-picture

with

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$ZnSO_4$-H_2O

ZINC SULPHATE (Monohydrate)

The many uses of "Virginia" Zinc Sulfate include chemical and pharmaceutical manufacturing, electroplating, glue and adhesives, paint trades, rayon and plastics manufacturing, metallurgical and agricultural applications. It is an exceptionally pure, 89 per cent granular, free-flowing crystal, and is quickly and completely soluble in water . . . zinc content, 36 per cent. Shipped in 100 lb. bags and 400 lb. barrels.

It may well be that "Virginia" Zinc Sulfate can play an important part in perfecting your processes. Our Research Department will be glad to survey your needs for possible applications. Call upon us freely. VIRGINIA SMELTING COMPANY, West Norfolk, Virginia. *Established 1898*

VIRGINIA *Chemicals*

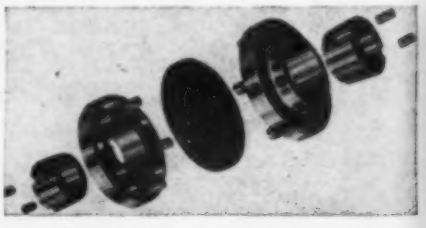
SULFUR DIOXIDE
SODIUM HYDROSULPHITE • ZINC HYDROSULPHITE
ZINC SULFATE

WEST NORFOLK • NEW YORK • BOSTON • DETROIT

offered by Zallea Brothers & Johnson, 888 Locust St., Wilmington 99, Del. Essentially, these new joints consist of two corrugated elements linked together by a section of pipe. The amount of lateral movement that can be absorbed depends on the length of pipe between the corrugated elements. Expansion elements of both non-equalizing (for 30 psi.), self-equalizing types for higher pressures, are available. Intended primarily for use in refineries and chemical process plants, these joints are said to be particularly suited for catalyst lines since there are no sharp crevices in which the catalyst can pack.

18. Flexible Coupling

ESPECIAL EASE of installation is claimed for a new pin-type flexible coupling embodying the well-known Taper-Lock bushing which is now being offered by the Dodge Mfg. Corp., Mishawaka, Ind. This bushing



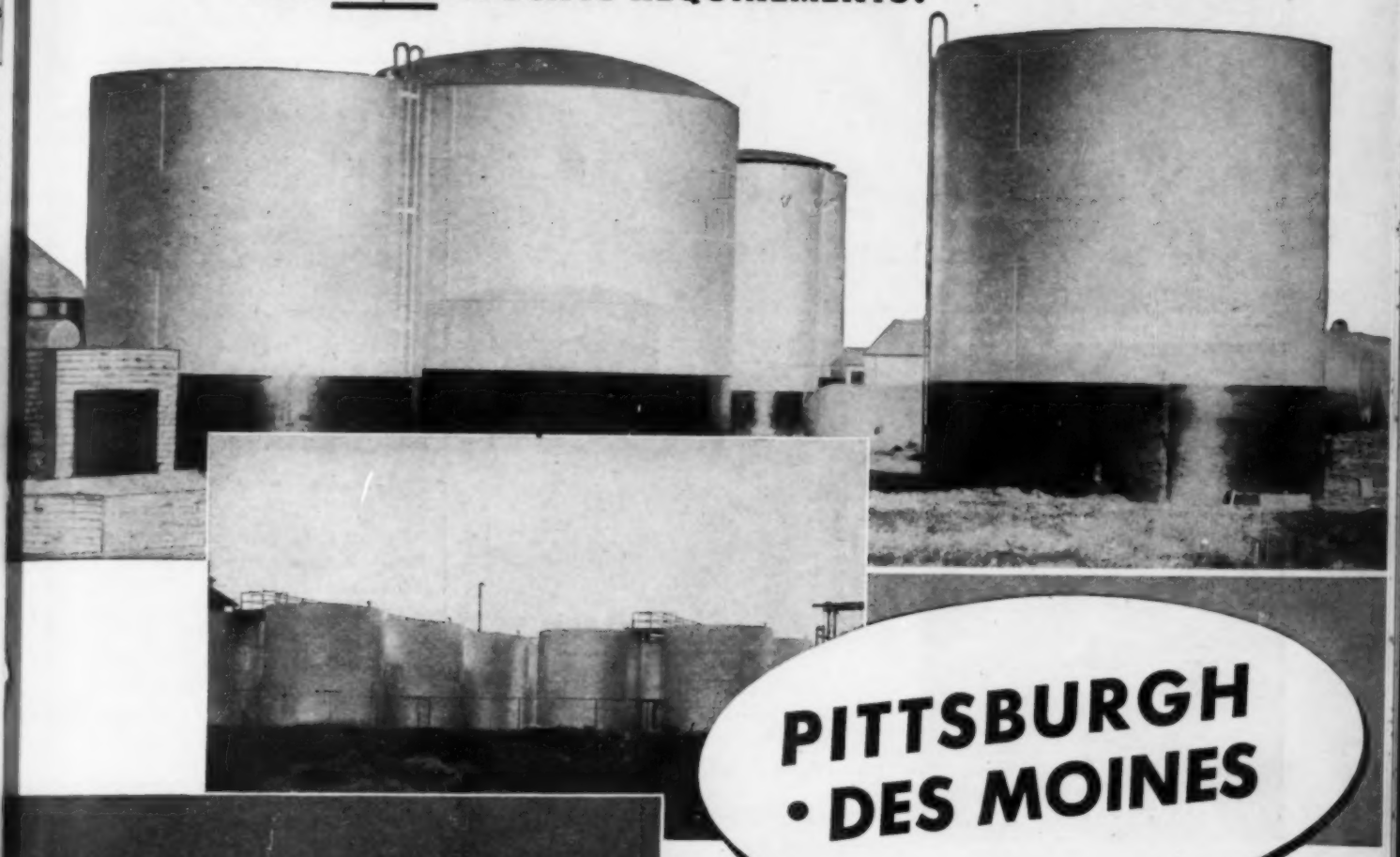
greatly facilitates installation and removal of the coupling from the shaft, since the split bushing may be slipped on to the shaft by hand, and is then automatically wedged into place as the flanges are attached. The coupling itself is of the type employing a center disk of oak-tanned sole leather, into which metal pins project through the alternate openings from the two flanges.

19. Plating Unit

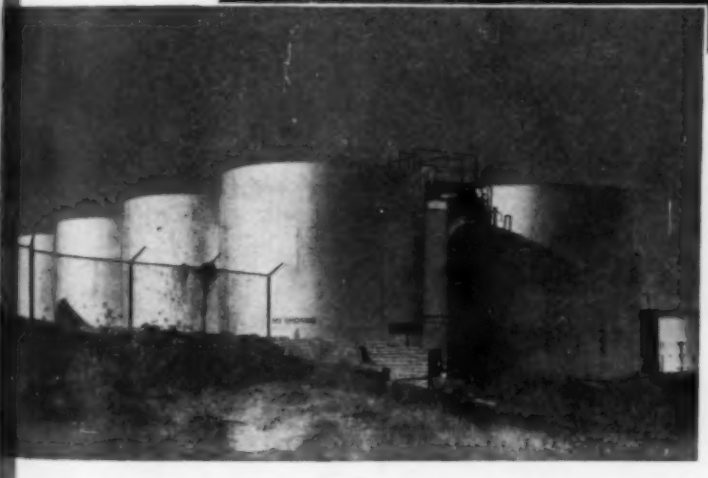
ELECTROPLATING units, prefabricated and requiring only the simplest of tools for assembly by the user, are being offered by Unit Process Assemblies, Inc., 75 East 4th St., New York 3, N. Y. Available in sizes for both laboratory and production purposes, these plants are intended for the plating of all metals as well as for anodizing, electropolishing and electroforming. The equipment includes all

Adaptable, Low-Cost Liquid Storage

FOR YOUR SPECIFIC REQUIREMENTS!



PITTSBURGH • DES MOINES



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PRECIOUS METALS SINCE 1875

231 NEW JERSEY R.R. AVE., NEWARK 5, N. J.

FOR MORE INFORMATION
See Reader Service Coupon on pages 169–170

necessary plating and process tanks, rectifiers, built-in gas, electrical, water, drain and exhaust lines. The equipment is shipped knocked down, and requires only connections to the main utility lines. Where necessary, each plating tank can be provided with a separate selenium rectifier with continuous voltage control over the entire voltage range. Rinse, dip and pickle tanks are located in front of, or adjacent to, the plating tanks.

Equipment Briefs

20. NYLON is now being used to construct the transverse cord breaker employed in its cord conveyer belts by the B. F. Goodrich Co., Akron, Ohio. This breaker consists of a layer of parallel cords embedded in the rubber and laid transversely on the belt to act as a shock absorber and retard gouging or cutting. The nylon is said to be at least 55 percent stronger than cotton in this service.

21. PREVENTION of freezing and galling of metal surfaces at temperatures as high as 1,800 deg. F., is claimed for a new thread compound known as Fel-Pro "Hi-Temp." This material, made by Felt Products Mfg. Co., 1504 Carroll Ave., Chicago 7, Ill., has been developed especially for high-temperature, high-pressure applications such as furnace tube header studs and plugs. In such applications it has been reported by users that stud breakage has been completely eliminated.

22. SMALL size and low cost are important characteristics of the new Model 300 electronic and dielectric heater now offered by Radio Frequency Corp., Boston 34, Mass. The new machine is intended both for experimental work and for small production operations, and can be used either for metal or for dielectric materials heating.

23. SPEEDS from 1,500 to 6,000 r.p.m., available under adjustable, stepless control are provided by a new variable-speed motor offered by Gurnet Electrical Machinery, Inc., Box 196, Meriden, Conn. This 1/5-hp. motor operates on 115-volt, single-phase current and is approximately 9 x 7 x 5 in. in size.

SWITCHING TIME CUT 50%

25-Ton G-E Switcher at Smith Lumber Company Will Pay for Itself in Four Years

Switching time cut in half! Availability 97.7%! A $350 per month saving! This is the record of the G-E 25-ton diesel-electric switching locomotive at the Smith Lumber Company, Chapman, Alabama. In June 1946 the 25-tonner replaced a 45-ton coal-burning steam locomotive. Eleven months later, Mr. N. F. McGowin, president of the company said: "The G-E diesel-electric locomotive is the best motive power for handling our switching requirements. It is available for service whenever needed with a reduction in operating and maintenance costs of better than $350 per month."

At this rate the switcher will pay for itself in less than four years.

ADDITIONAL BENEFITS

In addition to large savings the management has received other benefits. The G-E locomotive has slashed switching time by more than 50%. Inspection, refuelling and maintenance require only 16½ hours per month—a 97.7% availability. The new locomotive is safer too. Formerly, there was a continual fear of fire when the coal-burning steamer operated near the mill and timberlands. The new G-E diesel-electric has removed this serious fire hazard.

FIVE STANDARD MODELS

This performance is not unusual for G-E switchers. Hundreds of them now in use throughout the country are saving time and money in almost every type of industry. Whether your own requirements are heavy or light, you can obtain fast, low-cost switching with any of our five standard models: 25-ton, 45-ton, 50-ton, 65-ton, 80-ton. Your G-E representative will arrange a survey and estimate your savings in advance. See him today. *Apparatus Dept., General Electric Company, Schenectady 5, New York.*

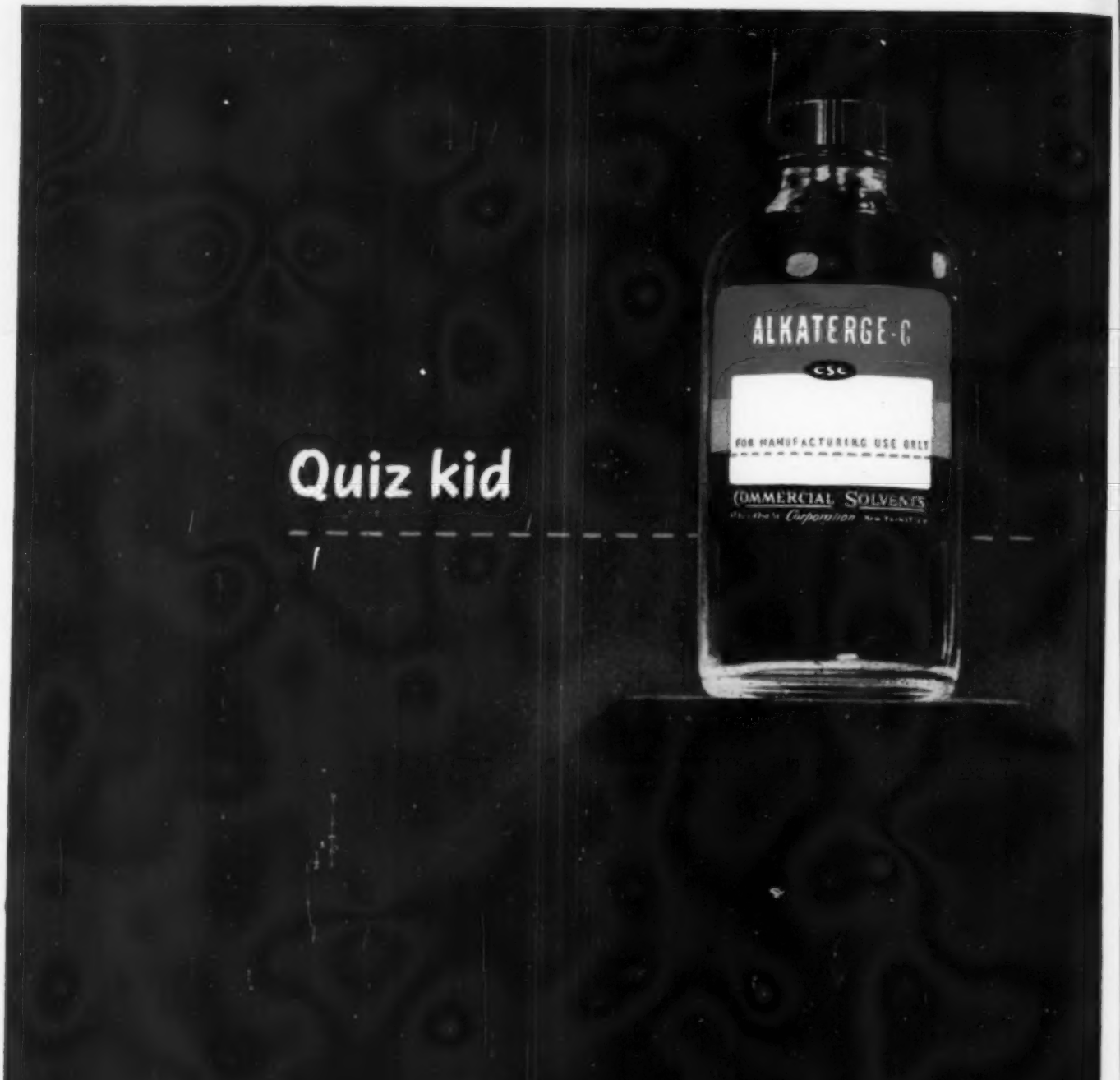
CLEAN OPERATION

Diesel-electrics give off no dangerous exhaust gases, and with these G-E switchers you'll virtually eliminate the nuisance of smoke and soot. This is particularly important if you are located in a smoke-conscious community.

Switch to Diesel-electrics and Save

GENERAL ELECTRIC

120-34



This sample bottle of CSC Alkaterge-C is on its way to answer a question. Somewhere, a manufacturer wants to know if this oil soluble surface-active agent can do a job for him. He will put this chemical specialty through a practical test in his own laboratory. If it solves his problem a. promptly as many CSC samples do, it will soon be followed by gallons and drums.

CSC

A request for such a sample is frequently the first step in making familiar products better, and new products possible.

COMMERCIAL SOLVENTS CORPORATION • 17 EAST 42ND STREET, NEW YORK 17, N. Y.

NEW PRODUCTS AND MATERIALS

Richard W. Porter, ASSISTANT EDITOR

51. Tung Oil Substitute

LATEST substitute for tung oil combines soya oil with styrene. Made by Spencer Kellogg & Sons Inc., Buffalo, N. Y., this new drying oil is called Ultrol. It is the condensation product of soya oil and styrene and forms hard, flexible, alkali resistant, waterproof films.

Requiring a minimum of cobalt drier, Ultrol dries in less than three hours. It possesses penetrating properties and can be used as a pore sealer. A high viscosity of Z to Z_4 on the Gardner-Holdt scale is obtained by bodying the oil. Ultrol is not compatible with vegetable oils but is soluble in high solvency mineral spirits and may be used with most pigments.

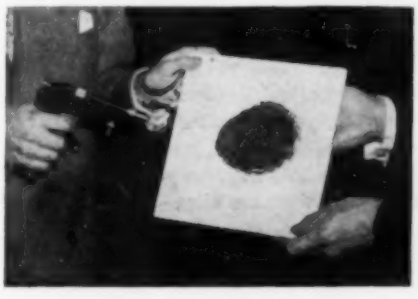
52. Mortar Sealant

FORMULATED for use in water proofing joints between glass block is a new mortar sealant made by the American Fluresit Co., Inc., 635 Rockdale Ave., Cincinnati, Ohio. Since the blocks are not porous, ordinary mortar has been found unsatisfactory because it cannot form a good mechanical bond, and cracks develop from shrinkage in the mortar. Water is absorbed into these openings, and when this water freezes, it cracks the glass block.

The new mortar sealant, with the brand name of Klee, coats the exterior mortar joints, adheres to the mortar and forms a tight flexible bond to the glass, expanding and contracting with the mortar as well as the glass without rupturing the film. It is of plastic-like consistency, and can readily be applied with a caulking gun, or thinned down with suitable solvents for brushing consistency. This product remains rubbery, and bonds tightly to mortar, glass, tile, brick, metal and wood. It is available in white, and can be furnished in other colors. It is packed in quart and gallon containers, and available in limited quantities.

53. Fire Retardant

A PRODUCT of wartime research at Harvard University, Albi-"R" is a fire retardant coating now made by Albi Manufacturing Co., Hartford, Conn. This coating, applied by brush or spray has demonstrated its effectiveness in a number of tests on various types of material. Under flame, a surface treated with this coating begins to blister and speckle much like a toasted marshmallow. Quickly there develops a tough, cellular mat which begins to swell until it protrudes from the surface. The mat acts as a heat insulator



against the flame. When the source of heat is removed, the mat can be scraped off and unless the flame exposure has been extreme, the under surface will not be charred. It can be scraped, sanded and restored to full protection. Less than 150 deg. F. of an acetylene torch's 1,700 deg. F. are transmitted by an Albi-"R" treated pine panel, and a maximum of 350 deg. F. through steel.

The material is shipped in powder form to be mixed with water. It can be used with any paint except those having sulphide pigments. Recommended is chemically pure chrome oxide to iron oxide paint. Application is widely varied, including pulp, wood and vegetable fiber boards and other interior combustible building materials. It may be tinted to any desired shade by adding colors. It bonds equally well to untreated or painted combustible surfaces. In one demonstration a fiber board slab treated with this material was unpenetrated after over 2 hours' exposure to a blow torch. Extensive applications are being made in the building construction field; metal and textiles are being subjected to both laboratory and commercial utilization of this coating, and important research is under way in aircraft fire protection.

54. Synthetic Emeralds

ONLY known commercial production of synthetic emeralds is now being carried out in San Francisco by Chatham Research Laboratories. Although many other efforts have been made to synthesize emeralds, none of these were able to produce an emerald that is equal to the natural stone.

Secret of the Chatham process is the technique of crystallization and

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Send us a sample of any stock you want to
PULVERIZE

SCHUTZ-O'NEILL offers you the benefit of more than a half century of experience in rapid, accurate, dustless pulverizing of any dry, grindable, non-gritty stock. Send us a sample of any stock you need to pulverize, stating fineness desired. We will make a test grind, and give you a report on the best method to use and the type of Schutz-O'Neill Pulverizer and any receiving or sifting equipment suited to your requirements. Acceptance of this offer for a test grind does not obligate you.

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Schutz-O'Neill engineers, after they know your needs, can suggest a Mill Plan with the correct size and type of pulverizer, receiver box, expansion tubular collector or cyclone collector, gyrator sifter, etc.

Schutz-O'Neill Style "D" Pulverizer, for fine grinding of dry, non-gritty stocks. Made in 6 sizes with capacities up to 2000 lbs. per hour.

The Schutz-O'Neill Gyrator Sifter turns out a large volume of uniform, clean product. 1 to 3 sieve frames for single or multiple separation.

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The RIGHT Answer
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Multi-Metal Wire Cloth, by the Piece, Yard and Roll, All Metals, Weaves and All Meshes

Whatever type Multi-Metal wire and filter cloth you choose, you can be sure of getting big money-saving advantages. Every square inch of Multi-Metal wire cloth is designed to give long life under corrosive conditions—stand up under heavy pressures—step up output—protect product purity. It's no wonder so many processing industries use Multi-Metal wire and filter cloth for efficient plant operation.

Multi-Metal wire cloth is available by the piece, yard or roll. Standard meshes, weaves and metals can be promptly supplied from stock. Special types can be made on order.

Write for free catalog. Better still, send along a sample of the cloth you now use for recommendations.

Multi-Metal
WIRE CLOTH COMPANY, INC.
1350 Garrison Ave., New York 59, N. Y.

More than 35 years of service to process industries

accurate control rather than the synthesis itself. The basic ingredients of emerald (Al_2O_3, BeO and SiO_2) are obtained in a high degree of purity by fractional crystallization, precipitation and calcination. Even a trace of most impurities or gases will give an imperfect product. The green color, which is easily controlled, is imparted by adding a trace of Cr_2O_3 and a small amount of Fe_2O_3. The pure ingredients are placed in a combination synthesis and crystallization unit where, under controlled high temperature and pressure, the synthetic emerald crystal grows from a seed over a period of about ten months. The element of time is of utmost importance. Crystal size is fairly easy to control. The most difficult part of the process is prevention and control of inclusions. Yield of emerald on the basis of BeO feed is about 5 percent.

Real significance of Chatham's work is believed to lie in other fields where his technique of crystallization might be applied to any highly infusible and insoluble material. A synthetic optical-grade calcite, which has a high industrial value, is one possibility.

55. Weed Killers

Two new weed killers have been announced by B. F. Goodrich Chemical Co., Cleveland, Ohio. The first of these, sodium isopropyl xanthate, is a water soluble organic chemical that destroys all growing plants. For this reason it finds use for the elimination of weeds from potential planting areas and can be used for the chemical weeding of growing crops. It can also be used as a defoliant.

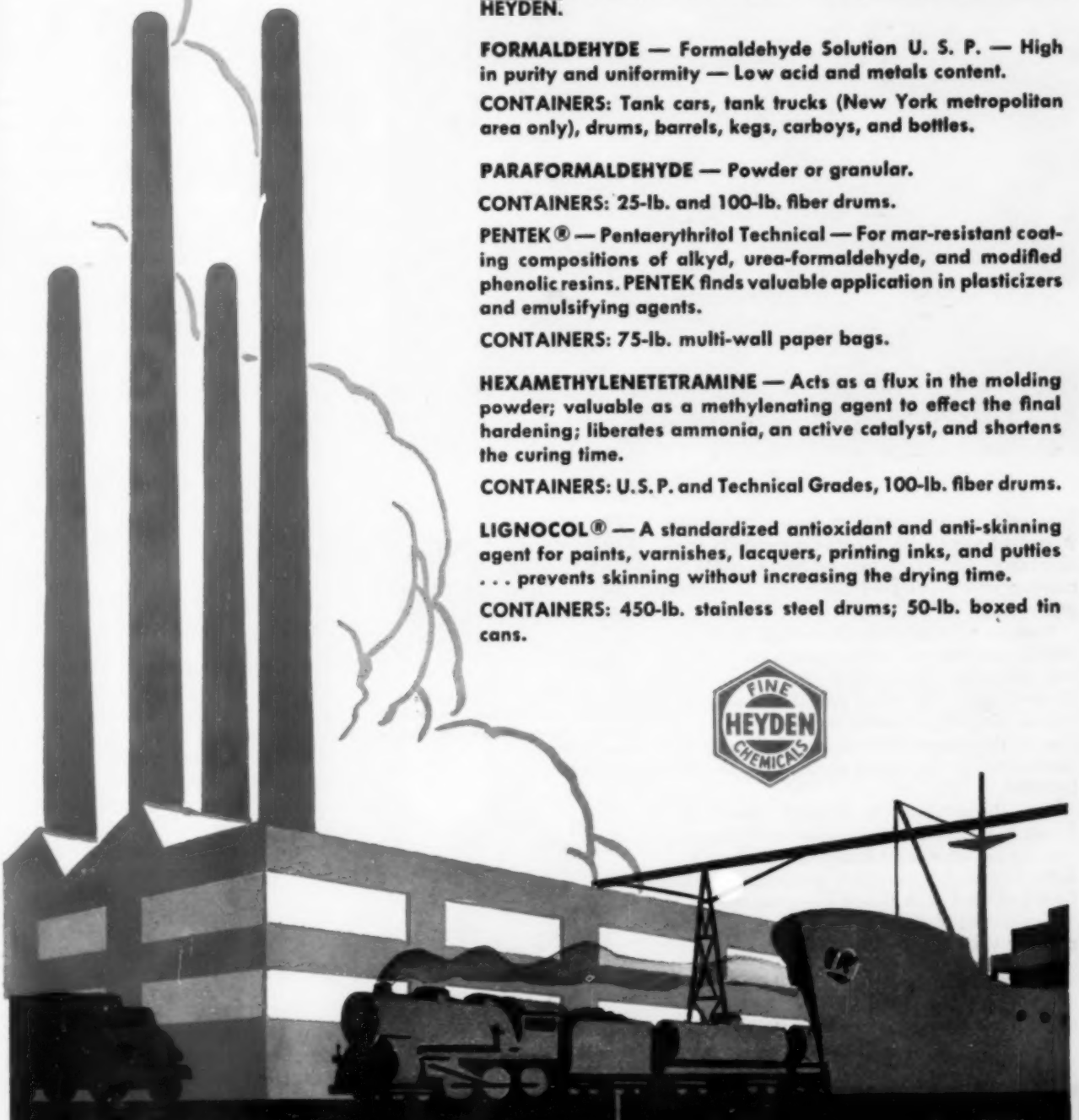
Second of these two chemicals is allyl mixed chlorophenyl carbonate and is a selective weed killer. The hormone-like action of this chemical arrests growth immediately and prevents seed development. It is particularly useful against certain types of grasses such as crab, barnyard, cattails and similar plants.

56. Animal Glue

Now available in commercial quantities is a semi-solid form of bone glue made by Swift & Co., Chicago, Ill. This new glue is a jelly at room temperature but when warmed to operating temperatures it becomes fluid. Known as Semisol this material is shipped in steel drums ready for use upon dilution and heating. Dilutions up to 100 percent may be practiced. Use of this type of glue eliminates the need for glue converting equipment since it is readily converted to useable form by simple dilution and heating.

HEYDEN chemicals serve the nation's industries

PLASTICS • RESINS



Performance and appearance, the keynotes of product excellence, are enhanced when you use *dependable chemicals* by HEYDEN.

FORMALDEHYDE — Formaldehyde Solution U. S. P. — High in purity and uniformity — Low acid and metals content.

CONTAINERS: Tank cars, tank trucks (New York metropolitan area only), drums, barrels, kegs, carboys, and bottles.

PARAFORMALDEHYDE — Powder or granular.

CONTAINERS: 25-lb. and 100-lb. fiber drums.

PENTEK® — Pentaerythritol Technical — For mar-resistant coating compositions of alkyd, urea-formaldehyde, and modified phenolic resins. PENTEK finds valuable application in plasticizers and emulsifying agents.

CONTAINERS: 75-lb. multi-wall paper bags.

HEXAMETHYLENETETRAMINE — Acts as a flux in the molding powder; valuable as a methylenating agent to effect the final hardening; liberates ammonia, an active catalyst, and shortens the curing time.

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LIGNOCOL® — A standardized antioxidant and anti-skinning agent for paints, varnishes, lacquers, printing inks, and putties . . . prevents skinning without increasing the drying time.

CONTAINERS: 450-lb. stainless steel drums; 50-lb. boxed tin cans.

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M.D.A. • Paraformaldehyde • Parahydroxybenzoates
Penicillin • Pentaerythritols • Salicylates

The Solvay soda process was commercially perfected in 1864. Ten years earlier, the first "Roots" Blower was produced. We're not good because we're old, but old because we're good.

MOVING! MIXING!
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MEASURING!

You gain an important, exclusive advantage, when you work with Roots-Connersville engineers on gas or air-handling problems, and in the moving and mixing of solids by pneumatic conveying.

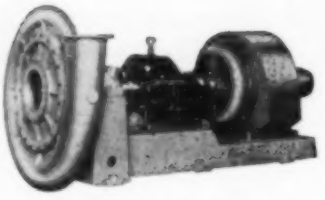
Because we build both Centrifugal or Rotary Positive equipment, we can recommend, without bias, the type best fitted to your needs. Only Roots-Connersville offers you this *dual-ability*.

R-C Centrifugal units incorporate the advanced thinking of skilled, ingenious engineers experienced in the unique needs of the chemical industry.

R-C Rotary Positive Blowers, Meters and Vacuum Pumps are the products of almost a century of blower building. Their simplicity, durability and dependable performance have been long-proved in almost every industry.

You'll find it profitable to move, mix and measure with R-C equipment.

ROOTS-CONNERSVILLE BLOWER CORPORATION
802 Illinois Avenue Connersville, Indiana



From our standard lines of Centrifugal and Rotary Positive Blowers, capacities are available from 5 CFM up.

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ONE OF THE DRESSER INDUSTRIES

Semisol is not damaged by freezing and it is protected against spoilage due to molds or bacteria.

57. Acetone Cyanohydrin

PRODUCED for many years as an intermediate in the manufacture of methyl methacrylate, acetone cyanohydrin has been made available for the first time to commercial users by Rohn & Haas Co., Philadelphia, Pa. It is expected that acetone cyanohydrin (a-hydroxyisobutyronitrile) will be of interest as an intermediate for synthesis. It contains two functional groups, a tertiary hydroxyl and a nitrile, and many of its reactions are those to be expected of these functional groups. These reactions include hydrogenation of the nitrile to give an amino alcohol, acetylation of the hydroxyl, and hydrolysis of the nitrile to produce a-hydroxyisobutyne acid.

Good yields of a-aminoisobutyronitrile and its *N*-substituted derivatives are obtained by reaction of acetone cyanohydrin with ammonia and with primary and secondary amines. The amino nitriles may be reduced to diamines or hydrolyzed to amino acids. The reaction of acetone cyanohydrin with ammonium carbonate gives a nearly quantitative yield of 5,5-dimethylhydantoin, which is readily hydrolyzed to a-aminoisobutyric acid. Simultaneous hydrolysis and dehydration of acetone cyanohydrin leads to methacrylamide sulphate in good yields.

58. Acid Inhibitor

AN ACID inhibitor for use in pickling solutions has recently been announced by Enthone Inc., 442 Elm St., New Haven, Conn. This liquid inhibitor which dissolves readily in pickling solutions, protects base metal from being attacked when scale, oxide, and rust are removed by pickling operations. It may be used effectively in both hydrochloric and sulphuric acid solutions to give an inhibiting action of over 90 percent.

59. Tetraethyl Pyrophosphate

THE LETHAL ingredient in hexaethyl tetraphosphate, the German developed insecticide, consists of tetraethyl pyrophosphate. A new insecticide under the brand name of Nifos-T contains 40 percent of this material and is claimed by its manufacturer, Monsanto Chemical Co., St. Louis, Mo., to be unusually effective against mites, aphids, and other crop pests.

Used in conjunction with DDT as a dust or spray, this chemical com-

Gaylord Boxes

MINIMIZE Your Shipping Risks . . .

Rough handling of your packaged product is an ever-present hazard.

But no matter how you ship—by rail, truck or air—Gaylord provides an extra margin of safety due to correct functional design, better materials, and precision manufacturing.

To minimize your shipping risks—insist on *packages by Gaylord.*

- Corrugated and Solid Fibre Boxes
- Folding Cartons
- Kraft Grocery Bags and Sacks
- Kraft Paper and Specialties

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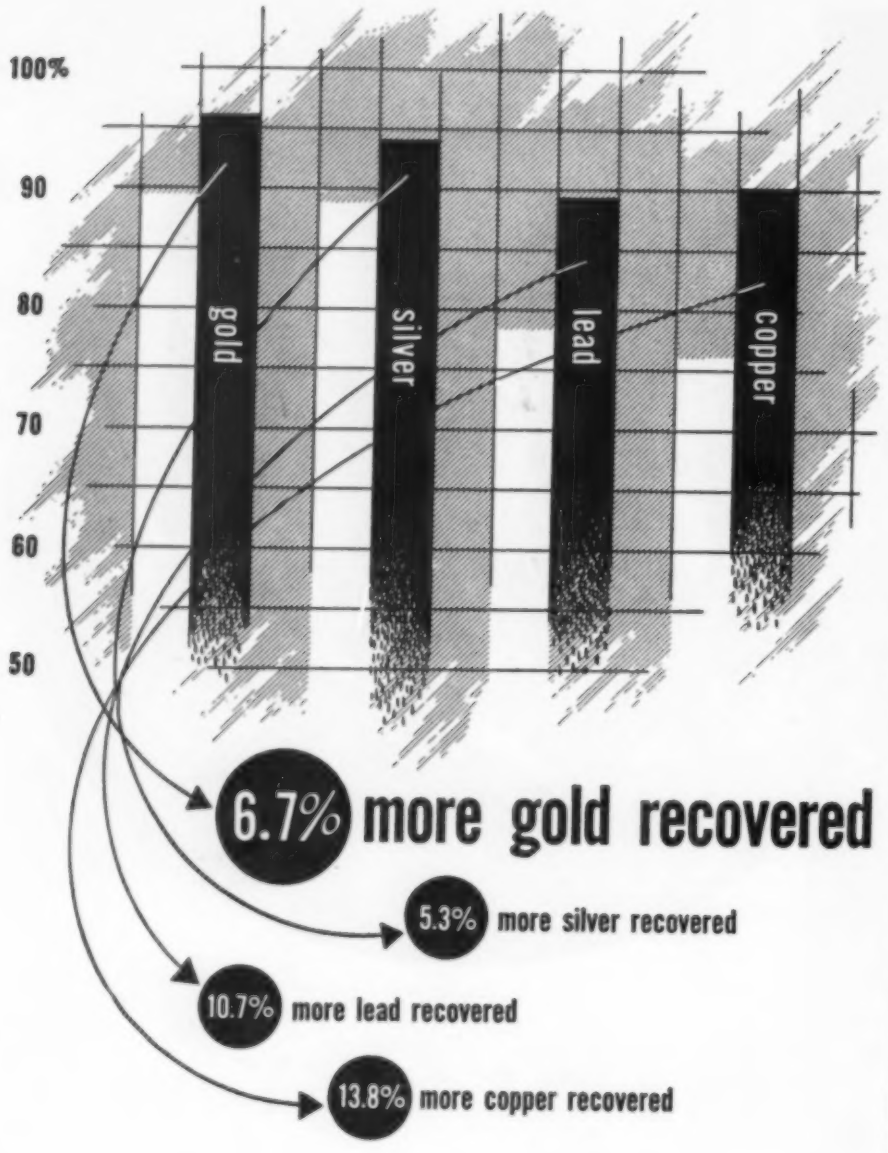

● These recoveries result from oxidized ore in a talc gangue when Metso® Granular is used as flotation aid. Only one pound of Metso per ton of ore is added.

There's double action from the Metso . . . the silicate deflocculates pulverized quartz, clay and other waste materials. At the same time it aids in the recovery of valuable metallic ores, which float on top of the froth.

Popular application of the principle of deflocculation with PQ® Silicate also is made for non-metallic minerals, such as clays, phosphate ores, fluospar and graphite.

Your answer to higher recoveries may be a PQ Silicate. Or you may have a different operation which can use PQ Silicate's deflocculating or flocculating power. Write or call our Technical Dept. for advice.

PHILADELPHIA QUARTZ CO., Dept. A, 119 S. Third St., Phila. 6, Penna.

PQ SILICATES OF SODA

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See Reader Service
Coupon on pages 169–170

pound will destroy mites and aphids that multiply abnormally after the extinction by DDT of their natural insect enemies. This insecticide will decompose to a relatively non-poisonous residue within a few days after use. Consequently, vegetables and fruits treated with it need not be washed before marketing.

60. Casting Resin

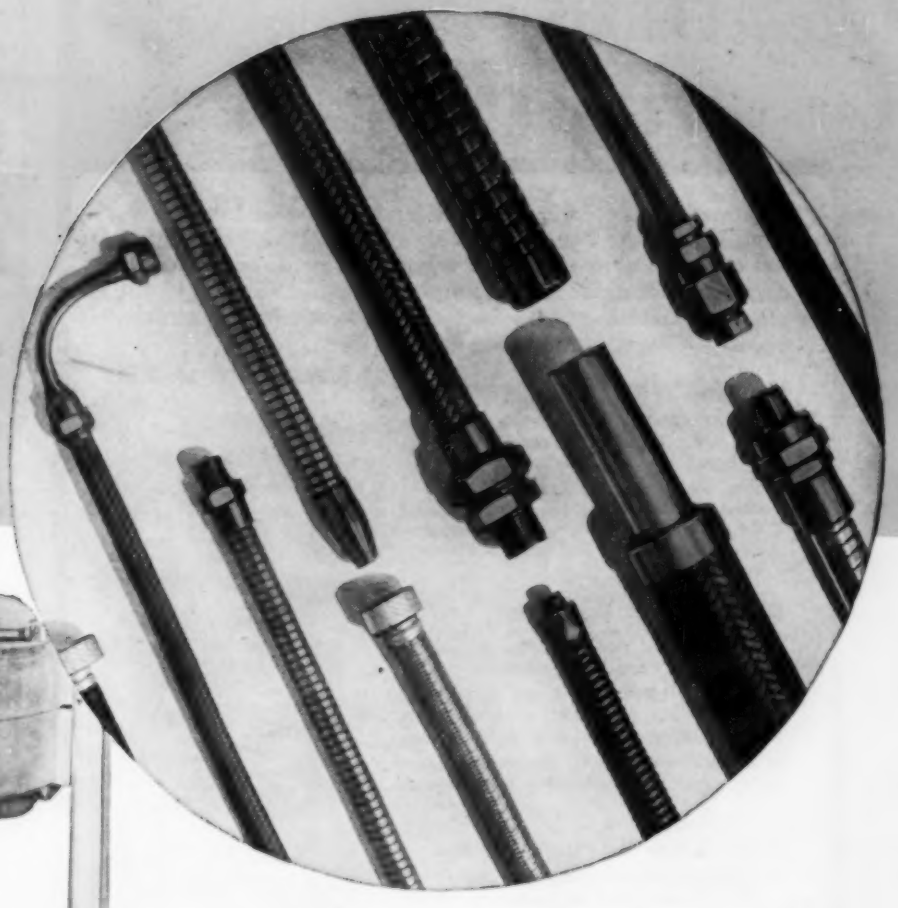
Now manufactured in commercial quantities by the Mathieson Alkali Works, 60 East 42 St., New York 17, N. Y., is a war developed casting resin known as NBS. Essential ingredient in the formula is the monomer dichlorostyrene. It is available as either a dichlorostyrene-styrene copolymer, for those preferring to mix their own resin as needed, or the formulated resin ready to be poured and then polymerized by the addition of a small amount of catalyst. The liquid resin is said to have satisfactory keeping qualities, especially when stored at low temperatures.

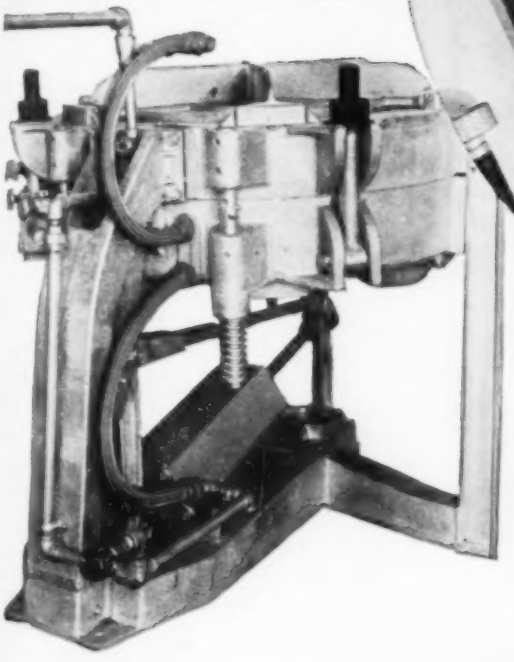
The properties of the casting resin developed by the National Bureau of Standards include low power factor, low dielectric constant, short polymerization period, small volume shrinkage on polymerization, high impact strength, electrical and dimensional stability, and low moisture absorption. The resin was developed originally for use in the radio proximity fuze and other small electrical assemblies. It is expected to find application in heavy industry, such as steel mills and plating plants, for protecting high-impedance control devices from fumes, high humidity, and mechanical damage. Other possible uses are in potting and sub-assemblies for radar equipment, hearing aids, portable radio transmitters and receivers, and subminiature electronic devices.

61. Diamyl Phenols

First of a series of alkylated aromatic compounds scheduled for production, the diamyl phenols are now available from the Chemical Division of Koppers, Inc., Pittsburgh 19, Pa. Diamyl phenols, as now produced, are a mixture of the isomers and the diamylated phenols. The amyl substituents include both secondary amyl and tertiary amyl groups attached mainly in the 2,4- positions. This ma-

FLEXIBLE CONNECTORS, *Made-to-Order* AT NO EXTRA COST





American Seamless Flexible Tubing, ¾" I. D., carries steam under pressure for vulcanizing purposes in this tire mold. Mold is Lodi Model F-2A, manufactured by the Super Mold Corporation, Lodi, California.

WE'RE LOOKING FOR TROUBLE. Trouble caused by vibration, misalignment, connecting moving parts, piping in cramped spaces – trouble that can be eliminated by properly designed flexible connectors.

Send your connector problems to American. *Your* connectors will be custom-made—complete with special end fittings attached—*at no extra cost*. Whether they involve the conveying of steam, oil, water, other liquids, semi-solids or gases, there is a certain type of American *Seamless* Flexible Metal Tubing, or Flexible Metal Hose, to give the most dependable service.

American *Seamless* is made from seamless bronze tube, corrugated for maximum flexibility and reinforced with bronze wire braid to make it usable under very high pressures. Seamless is standard in sizes ⅛" to 4" I.D. Flexible strip-wound hose, manufactured in brass, bronze, aluminum, steel and other metals in four spirally wound types —with joints packed or unpacked—is available in sizes ⅛" to 12" I.D.

Write for literature. And feel free to consult our Technical Department at any time.

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American Metal Hose Branch
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Subsidiary of Anaconda Copper Mining Company
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THE CANADIAN FAIRBANKS-MORSE CO., LTD.

FarriSeal

New FARRIS Safety Relief Valve

with protecting SEAL for working parts

Designed particularly to withstand the severe corrosive conditions of the Petro-Chemical Industries, this valve offers full and exclusive protection against all acids and caustics normally handled on a commercial scale. Result: Long life — maximum trouble-free service — minimum maintenance — low operating cost.

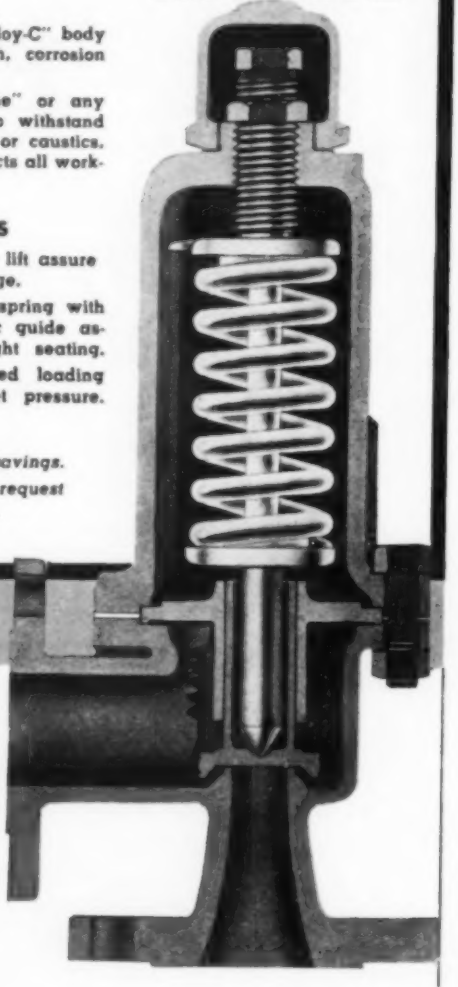
Here's Why

1. Haynes Stellite Co. "Hastelloy-C" body and disc is a hard, tough, corrosion resisting alloy.
2. The seal, rubber, "Neoprene" or any flexible metal — designed to withstand the action of specific acids or caustics, effectively isolates and protects all working parts.

Plus These Features

- Nozzle throat and high disc lift assure full certified capacity discharge.
- Precision alignment of the spring with the top-loaded free-acting disc guide assures positive action and tight seating.
- Long, low-stressed, protected loading spring maintains accurate set pressure.

Sizes: ½ in. to 2 in.



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Farris

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SAFETY and RELIEF VALVES

FARRIS keeps pace with advancing power and process engineering

terial is an oily, light straw-colored liquid which is miscible with both aliphatic and aromatic hydrocarbons, and is essentially insoluble in water and in 10 percent aqueous solutions of alkali hydoxides.

Although insoluble in dilute aqueous alkalis, the phenolic hydroxyl group will undergo such typical reactions as acetylation and reaction with ethylene oxide. Oily condensation products are also formed by reaction with formaldehyde. The product is suggested for use in the production of lubricating oil additives, modified phenolic resins, synthetic detergents, plasticizers, rubber chemicals and pharmaceuticals.

62. Synthetic Rubber

Now in semi-works production, new synthetic rubber that can be compounded and vulcanized in a wide range of soft to hard compositions was recently announced by the B. F. Goodrich Chemical Co., Cleveland, Ohio. Known as Hycar P.A., this product is identified as a polyacrylic ester and is an elastomeric material resembling in appearance natural, pale crepe rubber. Vulcanized forms exhibit good resistance to heat, oils, ultraviolet light, ozone and gas diffusion, and non-rigid compounds show good flexing life. Compounding, molding, extruding, calendering and curing operations are readily accomplished with standard rubber processing equipment.

Available in both dry and latex forms, Hycar P.A. in the unvulcanized state is expected to find many applications as an adhesive and as a coating or impregnant for fabrics and papers. Vulcanized products have shown good performance as heat-resistant coatings on fabrics, heat and oil-resistant gaskets, hose, belting, oil seals and other mechanical applications. As an insulation coating on electric motor coils, and as a heat and oil-resistant jacket for wire, polyacrylic ester shows promise of extending the usefulness of electrical products.

63. Strippable Plastic Coating

RECENTLY announced is a new strippable plastic coating, developed by the Watson-Standard Co., 225 Galveston Ave., Pittsburgh, Pa. Peelcote, as it is called, is an air-drying coating designed to protect metal parts from scratches, chips and corrosion during shipment, storage and handling. It can be applied by spray or dip methods and dries quickly. It is removed quickly and cleanly simply by pulling it off. Peelcote is a vinyl-based coating available in clear transparent or solid hiding black.

CHEMICAL ENGINEERING NEWS

Richard F. Warren, ASSISTANT EDITOR

CARBIDE & CARBON WILL OPERATE CLINTON LAB

CHANGING plans, the Atomic Energy Commission has arranged to turn over operation of Clinton Laboratory at Oak Ridge to Carbide and Carbon Chemicals Corp. Carbide and Carbon already operates the diffusion and electromagnetic plants there.

Last fall Monsanto Chemical Co. decided to quit its operation of Clinton. At that time it was planned to have Chicago University take over the laboratory in January.

Chemical knowledge which Clinton will be seeking is one of the keys to practical application of atomic energy. Uranium inserted into an operating pile is gradually transmutted into an intensely radioactive mixture of uranium, plutonium, and a number of fission products. In the wartime plant at Hanford, the plutonium was extracted in very complicated processes. Everything also was piled up for later study. This was wasteful. Now Clinton's problem is to find convenient and effective ways of separating the whole mixture. This includes extracting and isolating valuable fission products.

Stone & Webster Buys E. B. Badger & Sons Co.

IN JANUARY, E. B. Badger & Sons Co. was acquired by Stone & Webster, Inc. This move was made to expand engineering and construction activities of its subsidiary, Stone & Webster Engineering Corp., in the process and industrial fields. Badger and Stone & Webster organizations will continue to operate independently.

Esso Standard Opens New Lab Building at Baton Rouge

MURPHREE OUTLINES COMPANY PLANS AT JANUARY 12 CEREMONY; TELLS OF PRESENT WORK IN FIELD OF SYNTHETIC FUEL, CHEMICALS

A. Voorhies, Jr.

THE SIGNIFICANT present work and future plans of Standard Oil Co. of New Jersey and its affiliates in the field of synthetic fuels and chemicals were outlined by E. V. Murphree, president of Standard Oil Development Co., at the formal opening on January 12 of the new Esso Laboratories building in the Baton Rouge refinery. A. Voorhies, Jr., is director of Standard's Esso Laboratories at Baton Rouge. In a few months Esso plans to begin operating a large pilot plant at Baton Rouge to produce octyl and other higher alcohols. Also scheduled for large-scale pilot plant investigation is a new method for retorting oil shale by the fluidizing technique. Members of the Jersey group, said Murphree, are considering building facilities for the commercial manufacture of gasoline and byproducts by the gas synthesis process.

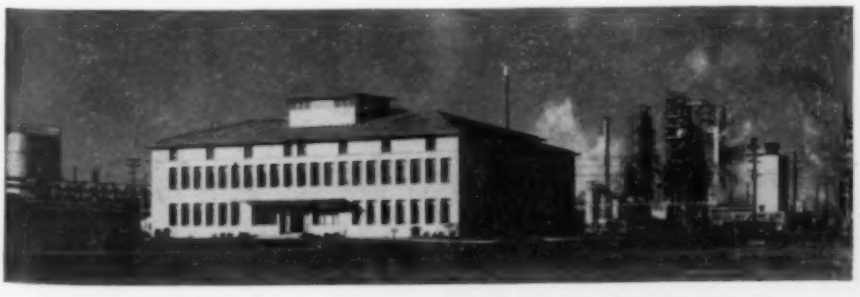
A large number of officials of Standard and its affiliates, together with members of the press, inspected the new building, a brick and reinforced concrete, three-story structure, which has become headquarters for the Esso Laboratories at Baton Rouge. The first and second floors, completely air conditioned, house the laboratories, staff offices, conference rooms, library, patent office and cafeteria. The third floor is given over to the building machinery and loops of utility piping provided with a highly elastic system of down-takes to facilitate changes when altering the use of rooms on the lower floors.

Laboratory rooms are equipped with all-steel furniture. As a safety precaution the air conditioning system operates on a once-through basis in order to prevent the carriage of flammable vapors from the point of origin.

Speakers of the Standard organization said that investigations to extend the fluid technique, used during the war to manufacture aviation gasoline by use of fluidized catalyst, occupy a large proportion of current effort. This work will be applied for the first time on a large scale at the Baton Rouge plant for the processing of hydrocarbon materials.

Much interest is centered about the conversion of a large hydrogenation pilot plant into a unit for the synthesis of higher alcohols, the principal objective being to produce plasticizers for various types of resins. The pilot plant, previously used for the destructive hydrogenation of gas oils, should be converted to its new function in a few months. Basis of the process is the combination, at about 3,00 psi, of carbon monoxide and hydrogen produced by the synthesis process, with olefins made in the refinery. Alcohols of chief interest at the outset will be those of the octyl group.

A new application of the fluidizing principle which will be tried at Baton Rouge by Esso is retorting of oil shale which will be supplied by the Bureau of Mines. Murphree said that "The cost of mining oil shale is a major item. It is likely, however, that a number of



Esso will use this new Baton Rouge building for fuel research

New $2,000,000 electric furnace plant of Victor Chemical Works which is nearing completion near Tarpon Springs, Fla. The plant will produce elemental phosphorus for shipment to other Victor plants at Nashville, Tenn., and Chicago Heights, Ill.

large shale deposits could be worked to yield oil products at somewhat lower cost than that of producing oil from coal."

A basic departure from conventional methods of retorting oil shale is the reduction of the material to small particles approximating the "fluid" state in order to apply heat at an extremely high rate and thereby avoid swelling and caking of the mass. The use of a single vessel, which has the disadvantage of mixing flue gases with the oil products, has already been tried on a pilot scale. A two-vessel system on a large pilot scale, where this disadvantage is eliminated, will be put into operation.

In the two-vessel process a small amount of steam is fed into the bottom of the retorting vessel in order to keep the incoming finely divided shale in a fluid condition. Retorted shale, containing some organic matter, then is carried with a stream of air into the bottom of a second vessel where heat is generated by combustion of the organic matter. Hot solids from the second chamber are then carried back into the base of the retort, along with steam, to furnish heat necessary to drive off the oils.

No prediction was made as to when Standard or one of its affiliates will build a commercial synthesis plant for the manufacture of gasoline and byproducts from natural gas, although such a project is under consideration. Present construction costs are a factor.

Victor Phosphorus Plant Nears Completion

VICTOR CHEMICAL WORKS is soon to complete the construction of a new electric furnace plant near Tarpon Springs, Fla., for the production of phosphorus. The plant is located in the heart of the great Florida phosphate rock deposits where about 80 percent of the total rock mined in the United States is produced.

The plant will produce elemental phosphorus for shipment to other Victor plants. As an incidental product, slag for road surfacing and concrete aggregate will be produced.

The $2,000,000 Victor plant is designed to provide the most modern equipment for the handling and processing of raw materials. The development includes an office building, employee change house and service building with first aid and medical facilities, chemical laboratory building, machine shop, storehouse, boiler plant, a complete water system, including pumping and treating facilities, and an emergency electrical generating plant to provide power for lighting and control apparatus.

The new plant increases the activities of all other Victor plants. From Tarpon Springs the phosphorus will be shipped to Nashville, Tenn., and to Chicago Heights, Ill., for processing to edible phosphates for use in food products.

Pennsalt to Build New Unit Near Paducah

PENNSYLVANIA SALT MFG. CO., will build a new fluorine chemicals plant near Paducah, Ky. The new plant will fill Pennsalt's requirements in its expanding production of fluorine chemical products, Leonard T. Beale, president, said in making the announcement.

Construction will start soon and the first unit of the plant is expected to be completed by February 1949. The new plant ultimately may include other products and is expected to be one of Pennsalt's largest. The first phase of the plant's operation will be devoted to production of hydrofluoric acid. The plant site is directly north of Calvert City, between Paducah and the new TVA Kenutcky dam at Gilbertville from which the plant will receive its electric power. The operation will occupy approximately 10 of the 500 acres which Pennsalt has contracted to buy. The plant will be close to rich Kentucky and Illinois fluorspar deposits, in which Pennsalt has reserve interests.

James McWhirter, formerly superintendent of the Natrona, Pa., plant, will be superintendent of the new operations. He was recently placed in charge of fluorine product process development and manufacture for the company. He will direct all phases of Pennsalt's fluorine products manufacturing activities.

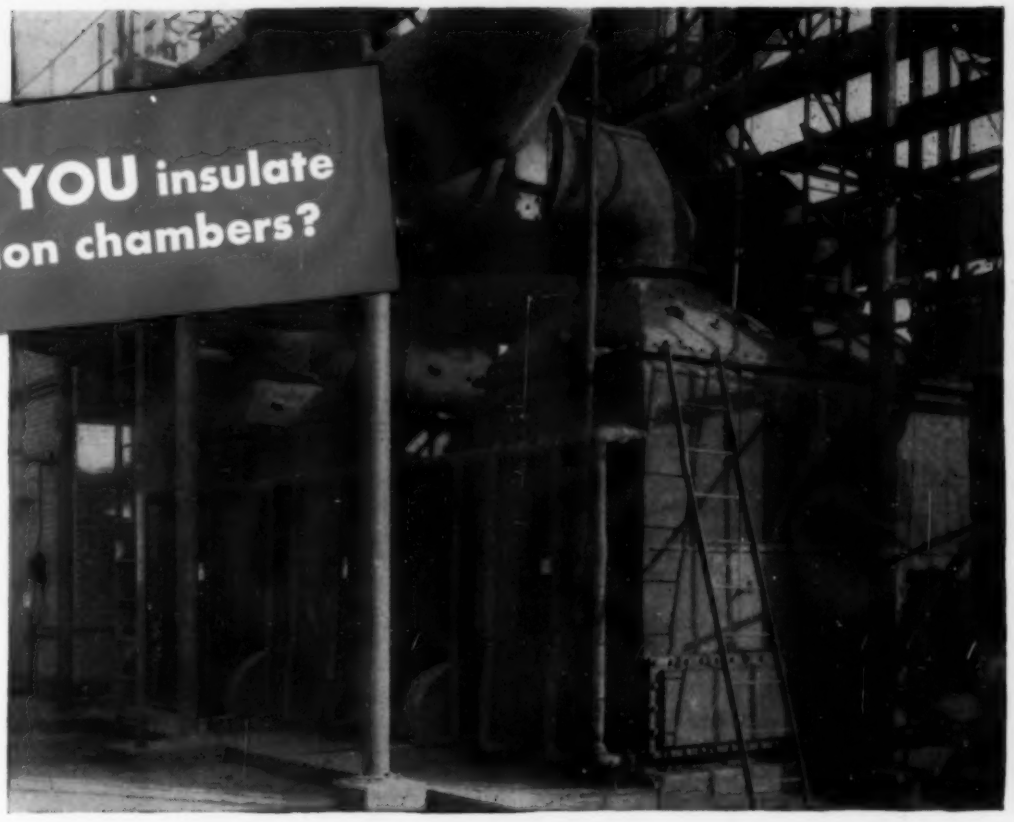
Illinois Is Building A New Chemical Engineering Lab

CHEMICAL engineering students at the University of Illinois will soon have a new, well equipped, laboratory. This new chemistry and chemical engineering building is under construction on the campus at Urbana. The chemical engineering division will occupy the ground floor and the first two floors of the building. Space on the third and fourth floors will also be used by the division for a pilot plant development laboratory.

In each floor above the ground floor there will be grilled spaces, 6 by 8 ft. This will permit installation of ex-

Illinois is adding this chemical engineering unit to its Urbana campus

How would YOU insulate these reaction chambers?



HERE'S THE PROBLEM: Outdoor processing vessels are in two sections. The upper must be held between 68° and 70° F., the lower above 212° F. Which insulation material or materials should be used?

☐ 2" of 85% Magnesia over entire vessel.

☐ 2" of 85% Magnesia on lower section, 2" of corkboard on upper section.

To remove gum compounds by electrical precipitation, manufactured gas is piped through the top sections of these boxes at a rate of 1 million cubic feet per hour.

The efficient operation of this equipment depends primarily upon holding the temperature of the gas between 68–70°. Above 70° the proper reaction does not take place and the removal of gum compounds may be retarded. Gas enters at 68° F., and if its temperature drops, moisture condenses, drips down, and cracks large glass insulators in the lower section of the boxes, short-circuiting the entire system. Steam coils heat this lower compartment to above 212° F. to protect the glass insulators against moisture.

What specification would you use to insulate these vessels?

HERE'S WHAT THE ARMSTRONG ENGINEER RECOMMENDED: Insulating the upper part of the equipment could be effectively accomplished with 2" of 85% Magnesia. The real problem, however, is in insulating the upper portion of the boxes against the critical two-degree temperature change.

In the range below 75° F., corkboard is a better insulator than magnesia. Therefore, the second method—using Armstrong's Corkboard on the upper section, with magnesia on the lower portion of the boxes—is recommended.

There's a positive advantage to you in the fact that Armstrong engineers are thoroughly familiar with low-temperature as well as high-temperature insulation work. A surprising number of jobs require both types of insulation.

When you call Armstrong's Contract Service for insulation advice, you don't need to divide up the work or the responsibility. You can simplify your whole procurement setup by dealing with this one dependable source of supply. It covers engineering over the entire range of processing temperatures from 300° below zero to 2800° F., supply of materials for that complete range, and provision of workmen to install these insulations properly.

FREE INSULATION CHART

This chart lists types and thicknesses of insulation for temperatures from 300° below zero to 2800° F. Write today to Armstrong Cork Co., Industrial Insulation Department, 3302 Maple Ave., Lancaster, Pennsylvania.

ARMSTRONG'S INDUSTRIAL INSULATION

Complete Contract Service For All Temperatures

From 300° Below Zero

To 2800° Fahrenheit

The Heart of a Good Filter is its FILTER LEAVES!

You Can Depend On
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FILTERS and FILTER LEAVES
• Positive Filtration . . . No Clogging
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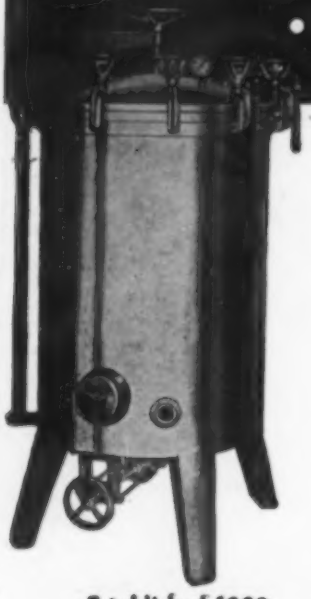

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Klein Filter Leaf—If damaged, metal cloth easily replaced. No rivets. Note horizontal headers—central duct—Klein Cleanout Cap.

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SERVE THE
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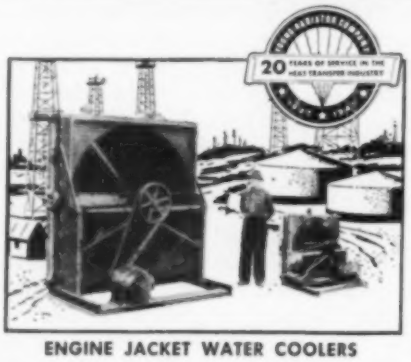
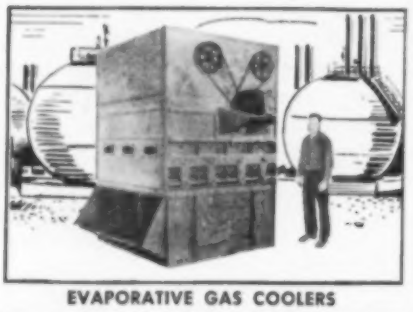
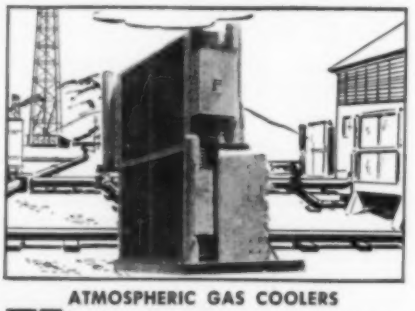


ENGINE JACKET WATER COOLERS



EVAPORATIVE GAS COOLERS



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perimental equipment 80 ft. high. One of the main features of the building is a large room extending upward to the height of three floors. This room will house the unit operations laboratory. Balconies in the room will provide operating levels at 9, 18, and 27 ft. Stacks on each side of the room will handle ventilation. A 12 ft. bay across the center of the main floor will permit trucks to drive into the laboratory. A traveling crane will handle heavy equipment. The ground floor will also have a constant temperature room, a constant humidity room, an electrochemistry section, student shop, machine shop, high pressure laboratory and a compressor room, as well as the unit operations laboratory.

The second floor will be used for research laboratories and plant design. It will also have a laboratory for measurements and control instrumentation. The biochemical division will also have laboratories in the building. It is

CONVENTION CALENDAR

Commercial Chemical Development Association, annual meeting, Roosevelt Hotel, New York, March 9-10.

Drug, Chemicals and Allied Trades Section, New York Board of Trade, Waldorf-Astoria, New York, March 11.

Chicago Technical Societies Council, technical conference, and production show, Stevens Hotel, Chicago, March 22-24.

National Association of Corrosion Engineers, fourth annual conference, Jefferson Hotel, St. Louis, Mo., April 5-8.

Third Southern Machinery and Metals Exposition. Municipal Auditorium, Atlanta, April 5-8.

Midwest Power Conference, sponsored by Illinois Institute of Technology, Sheraton Hotel, Chicago, April 7-9.

American Chemical Society, 113th national meeting, Chicago, Ill., April 19-23.

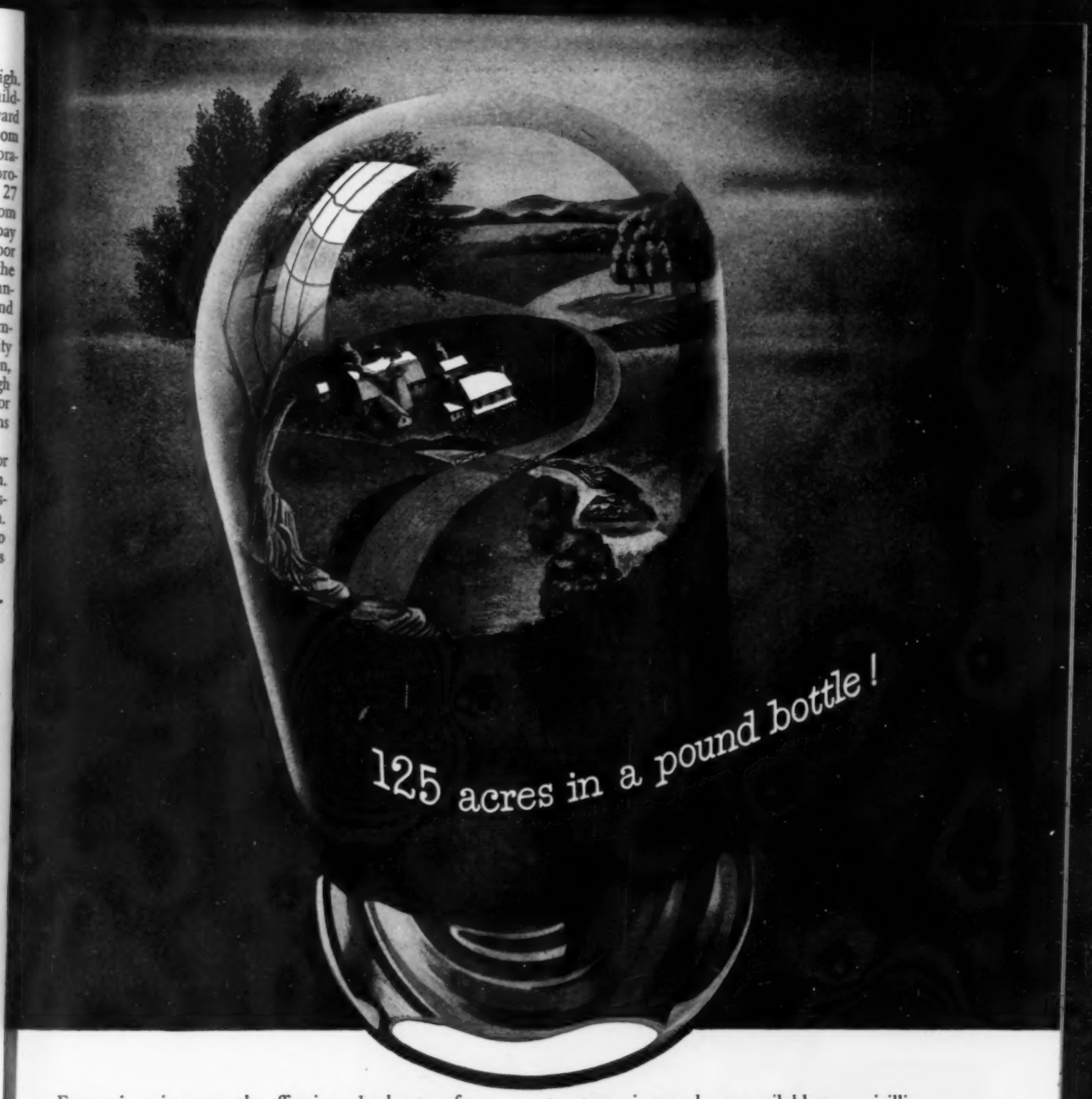
17th Packaging Exposition, Public Auditorium, Cleveland, April 26-30.

American Oil Chemists' Society, spring meeting, New Orleans, May 2-6.

American Institute of Chemists, annual meeting, Hotel Pennsylvania, New York, May 8.

Second Engineering Progress Show, Franklin Institute, Philadelphia, May 11-16.

Society of Plastics Industry, annual meeting, Ambassador Hotel, Atlantic City, May 20-21.



Fantastic as it seems, the effective *ad*sorbent surfaces of a pound of activated carbon are actually equal in area to about 125 acres.

We don't pretend to know how this can be possible, but our research men, who understand such things, have figured it out scientifically. We like to think of *what* it does rather than *how* it does it.

For example, when used to isolate streptomycin from the mold liquor in which it is produced, a *Pittsburgh* activated carbon, tailor-made for this purpose and with greater adsorptive capacity, assisted materially in the rapid development of a process with a capacity sufficient to permit removal of the "wonder drug" from the government's critical list. Soon streptomycin may be as available as penicillin.

Less dramatically, but like the producer of streptomycin, a manufacturer of water purification systems for homes, institutions, and industries tested every available adsorbent and then selected a *Pittsburgh* activated carbon which was specifically designed to meet the exacting requirements of his purification systems.

If your "problem" involves the use of an adsorbent, in gas or liquid phase, for purification, solvent recovery, decolorization, deodorization, fractionation, isolation, catalysis or air conditioning, you should investigate the adaptability of activated carbon to your processes. *Pittsburgh* activated carbon is produced in the types and grades usually required, or a special type can be developed for your specific need. Your inquiries are invited. Write for latest price list.

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The large scale operations of this organization would be costly without its efficient storage and distribution system which provides for the accurate measurement of every gallon of liquid.

With it, delivery and measurement of chemicals to the numerous processing centers become almost as easy as opening a valve. Waste is negligible and the entire inventory status can be determined any time on short notice.

Every Bowser product is designed to help industry do a better job . . . more economically. An experienced Bowser man will be glad to discuss the liquid handling problems of your plant. Write to Bowser, Inc., 1367 Creighton Avenue, Fort Wayne 2, Indiana.

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Automatic proportioner . . . for two or more liquids . . . with patented, precision volumetric meter control. Records quantity of each ingredient as well as finished product.

Automatic unit for filling containers in predetermined quantities from one pint to nine quarts. Temperature control and specific gravity adjustment.

Bowser Xacto Meters accurately measure liquids ranging from acids to wood oil. Gray cast iron, brass and bronze, or stainless steel construction.

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intended that the biochemistry and chemical engineering divisions will work together to contribute to the development of biochemical engineering.

Prof. J. C. Bailor, secretary of the department of chemistry is chairman of the building committee. Other members of the committee are Prof. H. F. Johnstone, Prof. W. C. Rose, Prof. H. E. Carter, Asst. Prof. C. S. Vestling, and Prof E. W. Comings.

Experts Discuss Synthetic Rubber in Washington

A DOMESTIC industry for production of synthetic rubber is "an essential asset" in the words of Rear Admiral C. E. Braine, moderator at a symposium of the Chemical Engineers' Club of Washington on January 13. In his opinon a natural rubber stockpile is desirable, and continued research should be supported on domestic natural rubber, with emphasis on guayule.

Congressional action was discussed by Congressman Fred Crawford, vice chairman of the Rubber Subcommittee of the House Armed Forces Committee. In his opinion, capacity to produce GR-S should be maintained at approximately 600,000 tons per year, with a mandatory production rate of one-third this capacity, whether by industry or by government. Additional 75,000 tons of butyl rubber capacity should be maintained, and approximately one-third of the capacity operated. Compulsory consumption should be established by Congressional legislation, if necessary.

G. B. Hadlock, executive director of the Office of Rubber Reserve, felt the synthetic industry, representing three-quarters of a billion dollars addition to our industrial economy, had already won a secure place. Outstanding among the peace-time benefits of this wartime industry was the assurance to rubber processors of a plentiful supply of raw material at a reasonable price, something less than 20 percent of the natural rubber price following World War I.

State Department views on the situation were expressed by William T. Phillips of the International Resources Division. While he regarded a synthetic rubber industry as essential, in addition to an adequate stockpile of natural rubber, he felt that operation of this industry should be held to a minimum "mandatory" usage of synthetic rubber for national security. This minimum would be determined by the Munitions Board, or other appropriate defense agency.

R. P. Dinsmore, vice president of Goodyear, regarded 100,000 tons per

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● Narrow aisles, limited floor-loading capacity, congested areas, small and low-capacity elevators no longer need deprive plants of the advantages of mechanized handling with electric fork trucks. Designed to meet these specific problems, this new truck finds application wherever loads may be limited to 1000 lbs. Its low price makes it possible to use fork trucks and pallets on many applications for which the cost of equipment, in the past, was not justified.

Baker Type FQH Center-Control Fork Truck

Capacity: Standard rating 1000 lbs. for 30 inch load length.

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Weight: Truck complete with Battery 2805 lbs. Weight with full load (3805 lbs.) permits use on floors having limited capacity, on low-capacity elevators, and for loading highway trucks.

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Dimensions: Overall length, excluding forks, 53⅜ inches. Width 28 inches. Turning radius—outside—60 inches. Requires only 97½ inches with 30 inch load to make right angle turn. Tilting-telescoping fork lift of 108 inches with 83 inch overall nested height.

●

Power Equipment: Battery suitable for full 12-hour operation.

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Charging Equipment: Single-circuit motor-generator charger with automatic charge control and shut-off.

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Price: Complete with battery and charger $2791, with battery only $2441.

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est Baker representative or write us direct.

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of The Baker-Raulang Company
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Canada: Railway & Power Engineering Corporation, Limited

Pick up, Move, Put down, Repeat

When an electric overhead traveling crane will pick up, move, put down heavy loads over and over again — and do it all economically, smoothly, safely — year after year, that's sweet music in the ears of plant engineers and cost accountants.

Ordering an overhead traveling crane that will handle your lifting and moving work involves more than just specifying top capacity. With a Shepard Niles overhead traveling crane you get the capacity you need, sound design, rugged and precise construction and reserve strength — as well as assurance of trouble-free operation. But you get much more. You get an overhead traveling crane designed and built to handle your own particular job.

Trained, experienced Shepard Niles engineers have data on thousands of crane installations, in every type of industry. All this information and experience is available to you without obligation. Let a Shepard Niles engineer help you select the crane best suited to you, out of the many sizes and types available.

★ We are unbiased in our recommendations. If a survey of your material handling shows you need an electric hoist instead of an overhead traveling crane, Shepard Niles will recommend a hoist. America's pioneer builder makes both electric overhead traveling cranes and electric hoists for every need.

Shepard Niles
CRANE & HOIST CORPORATION

382 SCHUYLER AVENUE • MONTOUR FALLS, N. Y.

year as a minimum necessary production by government operation after a stockpile of approximately 150,000 tons has been built, in addition to about 800,000 tons of natural rubber. Industrial operation of the industry should then be arranged with a minimum of government control. Twelve-cent natural rubber was anticipated in the not-too-distant future, and his lack of enthusiasm for taking over the synthetic rubber industry appeared to be based on that premise.

J. P. Coe, U. S. Rubber Co. vice president, was more optimistic when viewing the future of synthetic rubber from the technologic side. In his opinion GR-S has proved itself, independent of its relation to national security. Fifteen-cent synthetic rubber seemed quite practicable to Mr. Coe, and natural rubber at 15 to 20 cents seemed more likely than Mr. Dinsmore's estimate of 12 cents.

National Research Council Offers Fellowships

A NEW group of fellowships has been offered by the fellowship board of the National Research Council. They are sponsored by the Carnegie Corp., New York. Funds have been provided for several post doctoral fellowships in both a natural and a social science. For men with a doctor's degree in a natural science, the fellowship will permit two years of supplementary training in a social science. The fellowships are open to U. S. citizens holding Ph.D. degrees. The stipends will range from $2,500 to $5,000 per year.

Applications or inquiries should be addressed to the Fellowship Office of the National Research Council, 2101 Constitution Ave., Washington 25, D. C.

Arkansas Sets Up Institute Of Science & Technology

ESTABLISHMENT of the Institute of Science and Technology to conduct both fundamental and applied research has been announced by the University of Arkansas. The four-point program is described as follows:

(1) To assist in developing training in science and technology at the university. (2) To coordinate and foster research in the fields of chemistry, physics, engineering, agriculture, and other physical sciences. (3) To provide research on a contract basis for individuals and organizations. (4) To cooperate with public and private research agencies on problems of mutual interest and to aid the Arkansas Resources and Development Commission, the Economic Council-State

What's Happening in Tower 5?

A logical question. The answer should be at the finger tip of the man responsible.

You can put your finger on processing temperatures anywhere as quickly as you touch a button. The Brown *ElectroniK* Precision Indicator *brings temperatures to you* with a speed and accuracy unparalleled by any other form of instrumentation today.

It is available with as many as 48 push-button switches for picking out temperatures anywhere in your plant. A new form, now available, even provides for cutting in on recorder circuits to check all critical temperatures from one central location.

The 28-inch rotating scale makes split-degree readings easy, yet with the *ElectroniK* Potentiometer, operation is so fast and accurate that a series of temperatures can be read as fast as they can be logged.

Far-flung as your processes may be, the Brown *ElectroniK* Precision Indicator will help "pull your plant together" with efficient, centralized temperature readings.

Further information will be gladly forwarded to you.

THE BROWN INSTRUMENT CO., 4478 WAYNE AVE., PHILADELPHIA 44, PA.
DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.

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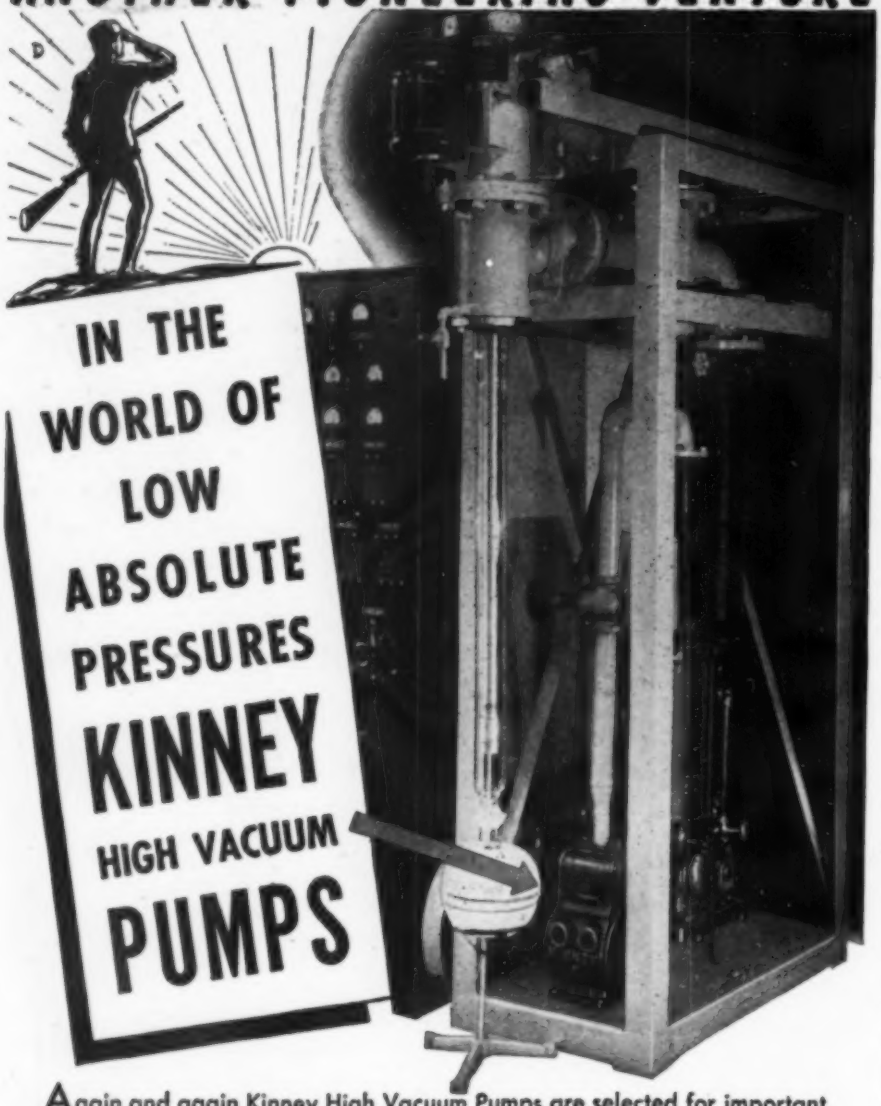
BROWN *Advanced Instrumentation* FOR BETTER PROCESSING

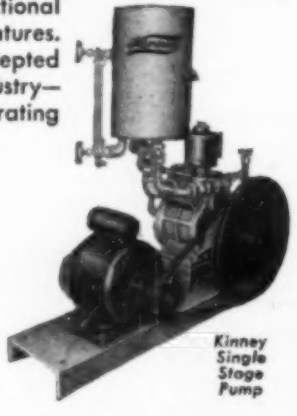
Product of MINNEAPOLIS **Honeywell**

ANOTHER PIONEERING VENTURE



IN THE WORLD OF LOW ABSOLUTE PRESSURES KINNEY HIGH VACUUM PUMPS

Again and again Kinney High Vacuum Pumps are selected for important projects in the ever-widening field of low pressure processing. In this new high vacuum Rotary Fractionating Still, manufactured by National Research Corporation, Cambridge, Mass., the Kinney Vacuum Pump is an integral part of the compact unit and backs a diffusion pump to maintain extremely low absolute pressures for the fractional separation of liquids at relatively low temperatures. Kinney High Vacuum pumps are widely accepted for dependable low pressure processing in Industry—from exhausting lamps and tubes to dehydrating food, producing drugs, sintering alloy metals and performing countless other operations. Their compact design saves floor space and their rapid pump down to low ultimate pressures shortens production time. Kinney Single Stage pumps create and maintain low absolute pressures to 10 microns; Compound pumps to 0.5 micron.



Kinney Single Stage Pump

Write for Bulletin V45

KINNEY MANUFACTURING COMPANY

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Chamber of Commerce and other groups engaged in industrial and agricultural development of Arkansas.

W. W. Grigorieff has been named director of the Institute. A chemical engineering graduate of the Swiss Federal University at Zurich, he was engaged in chemical research work at the Pittsfield, Mass., laboratory of General Electric before joining the university staff two years ago.

Louisiana Engineers Urge State Licensing Law

SUPPORT of a law to require the licensing and registration of all types of professional engineers in Louisiana has been voiced by the Louisiana Engineering Society. The necessity for such legislation was outlined a few weeks ago in New Orleans at a meeting of the society by C. L. Nairne, the retiring president. Nairne said the organization would draft a bill to be introduced at the next session of the state legislature. He added that a committee has been working on the measure and that the proposal has the backing of other engineering groups in Louisiana.

Tung Oil Extraction Plant Completed at Gulfport

AMERICAN TUNG MILLS of Mississippi has completed at Gulfport, Miss., a $200,000 plant for the extraction of tung oil, the production of which is being stepped up rapidly on the Gulf Coast. Capacity of the plant is 100 tons of tung nuts per day. The company has several hundred acres of tung planted in Mississippi at present and expects to enlarge its holdings each year.

Another tung crusher, Bogalusa Tung Oil Co., has begun operations at Bogalusa, La., and is crushing between 30 and 40 tons of nuts per 24-hr. day. The company expects to handle about 5,000 tons this season.

Texas Co. Plans Expansion of Oklahoma Refinery

THE TEXAS CO. will soon begin a large construction program to modernize and increase the capacity of its West Tulsa refinery in Oklahoma. It is estimated that the program will involve an expenditure of $5,000,000 or more.

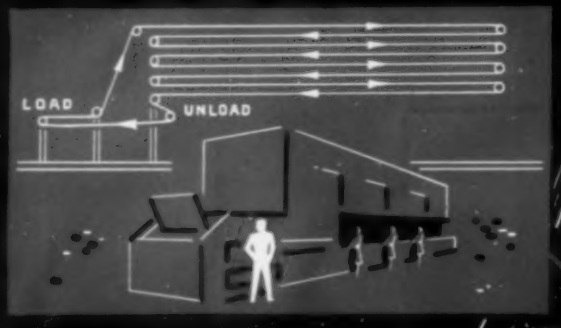
Last month some preliminary work was under way, and initial work was being done prior to the building of foundations. Included in the program will be the construction of a fluid catalytic cracking unit and new equipment for the atmospheric and vacuum

LIKE TO HORN IN ON A GOOD THING?

If your product requires cooling, heating or drying, it's in fortunate company because it puts you right in line for important new savings in materials-handling costs and valuable floor space . . . with increased production and improved quality as automatic by-products.

Right now, many manufacturers in a variety of industries are profiting by installations of Greer Multi-Tier Conveyors because they eliminate the need for large plant areas for storage of goods in process . . . they eliminate materials handling . . . and they allow conversion from batch methods to faster, more efficient, continuous processing.

So, again, if your product is cooled, heated or dried at any stage between raw material and final packaging, a Greer representative will be glad to show you how to "horn in" on these substantial benefits. Write for Bulletin 45-3. The J. W. Greer Company, 124 Windsor Street, Cambridge 39, Massachusetts. No obligation, of course.



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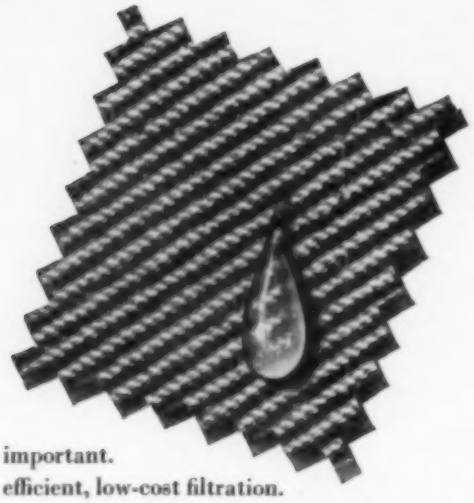
FOR CONTINUOUS COOLING, HEATING, DRYING

MORE AND BETTER PRODUCTION
IN LESS FLOOR SPACE

the right filter base



■ Choice in filter bases is important.
The right type is necessary for efficient, low-cost filtration.
Let Sperry recommend it for you. We've had more than 50 years filtration experience. And we have a complete stock of bases—covering a wide range of industrial applications.

Sperry engineers have developed bases in paper, cloth, vinyon, asbestos, rubber, glass and woven materials. If a special type is indicated, Sperry can supply that.

Whatever your filtration problem, call in Sperry today for an accurate analysis. Chances are you'll increase production efficiency. There's no obligation.

D. R. SPERRY & COMPANY, *BATAVIA, ILLINOIS*

Filtration Engineers for Over 50 Years

SPERRY
FILTER BASES

VITREOSIL PIPES

Non-porous. Light weight, Electrically resistant at elevated temperatures. Free from metallic impurities. Homogeneous and of uniform quality. Highest temperature shock resistance of any ceramic material. Withstand severest chemical conditions. Ideal for conveying acid liquids and gases; reactions at high temperature; sintering; chloridizing; heat treatment; high vacuum; and controlled atmosphere techniques. Sizes up to 30" bore. For details write for Bulletin No. 7.

TUBING

Opaque, Translucent or Transparent. Has similar characteristics to Vitreosil Pipes but is available in smaller sizes. Produced in four qualities — (1) sand surface; (2) glazed; (3) satin surface; (4) transparent. Made in diameters and lengths to customers' specifications. For details write for Bulletin No. 9.

VITREOUS SILICA — VITREOSIL

THE THERMAL SYNDICATE, LTD.
12 EAST 46th STREET, NEW YORK 17, N. Y.

distillation of crude oil. It is expected when the new equipment is completed the capacity of the Tulsa refinery will be increased to 30,000 bbl. per day, an increase of 50 percent over current crude capacity.

Glass Company Expands its Container Output

BROCKWAY GLASS CO. is installing facilities to increase the production of its plant at Muskogee, Okla. A new batch house, which should be completed by March, is expected to increase the manufacturing capacity by 20 percent.

The company which began production in 1946, manufactures a full line of containers, including wide mouth and narrow mouth food packers and wine, chemical, household and beverage bottles. Current capacity is about 225,000 containers per day.

Columbian Carbon Buy Surplus Texas Carbon Black Unit

COLUMBIAN CARBON CO. has purchased for $1,420,000 from War Assets Administration the carbon black plant at Seagraves, Tex., which the company has had under lease from the government agency. The plant was operated during the war to produce channel black for use in the manufacture of rubber.

Stauffer Makes Ben Hex At Nevada Plant

BENZENE hexachloride is now being produced commercially by Stauffer Chemical Co. in a new manufacturing unit at Henderson, Nev., states the company's T. B. Gibson. Raw materials include chlorine from Stauffer's 200 ton caustic-chlorine plant at Henderson and benzol from the Columbia Steel Co. operations at Geneva, Utah. The process involves direct chlorination of benzol with actinic light. A number of refinements, worked out by Stauffer's research department, have been incorporated and special equipment was designed for the unit. Design capacity is large enough to enable the company to become an important factor in supplying the growing national demand for this insecticide. Because of favorable location with respect to raw materials, the unit is expected to become a low-cost producer.

At least five isomers of hexachlorcyclohexane have been isolated from technical benzene hexachloride. Only the gamma isomer, which normally comprises 10-12 percent by weight of technical BHC, has shown marked toxicity to insects. Stauffer's new plant

"I didn't know you people made_____!"

Fill in to suit

We have been in business now for 58 years and yet quite often some good customer of our says — "Why, I didn't know you people made friction clutches!" Or the exclamation might cover skip hoist drives, car pullers, door hoists or any one of many other Jones products.

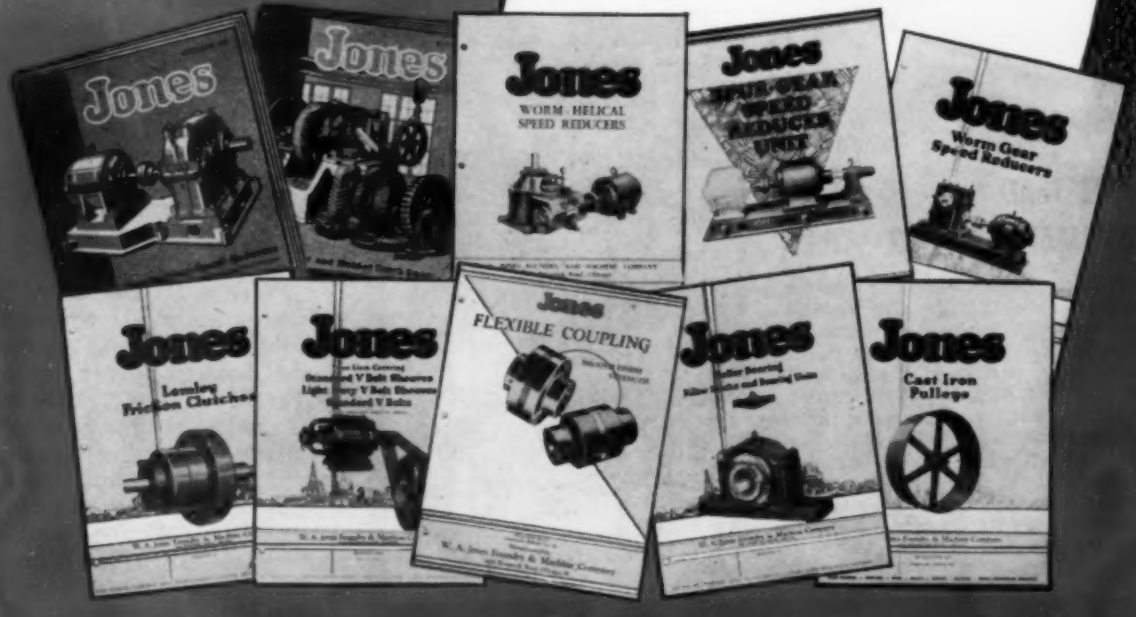
In dealing with our suppliers we often find ourselves in the same position. We establish certain buying habits and it sometimes comes as a shock to find that a firm right around the corner may have just the services or the products we need.

We therefore present the group of catalogs shown below with the thought that some one of them may help you solve some problem that has just come up.

W. A. JONES FOUNDRY & MACHINE CO.
4415 Roosevelt Rd., Chicago 24, Ill.

Any, or all of these Jones Catalogs sent on request

No. 70—Jones Herringbone Speed Reducers
No. 71—Jones Cut Gears
No. 75—Jones Worm Helical Speed Reducers
No. 55—Jones Spur Gear Speed Reducer Units
No. 68—Jones Worm Gear Speed Reducers
No. 60—Jones Friction Clutches
No. 588—Jones V-Belt Sheaves
No. 78—Jones Flexible Couplings
No. 56—Jones Roller Bearing Pillow Blocks
No. 69A—Jones Cast Iron Pulleys



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HERRINGBONE — WORM — SPUR — GEAR SPEED REDUCERS
PULLEYS • GEARS • V-BELT SHEAVES • ANTI-FRICTION
PILLOW BLOCKS & FRICTION CLUTCHES • FLEXIBLE COUPLINGS

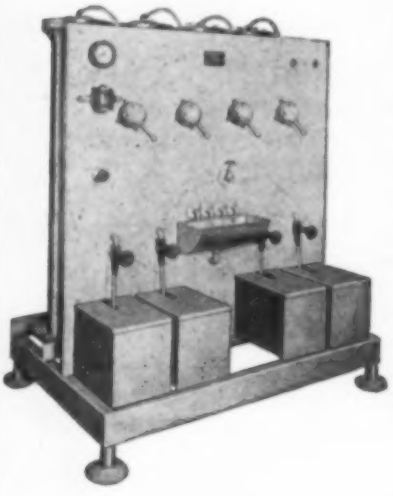
Need PURE Water?

Specify Dependable

Barnstead Equipment

Specialists in Pure Water Since 1878

Almost 70 years ago Barnstead designed and built the first Automatic Water Still. From that Still to the outstanding new Barnstead "Double-Action" Demineralizer we have had one aim — to produce purer water at lower cost with greater ease. The many Barnstead improvements in design over these years have resulted in a far purer water at a fraction of the original cost. If your requirements for either distilled or demineralized water are from ½ to 1000 gallons per hour, you can satisfy them best with one of the 200 models and sizes in the complete Barnstead line.

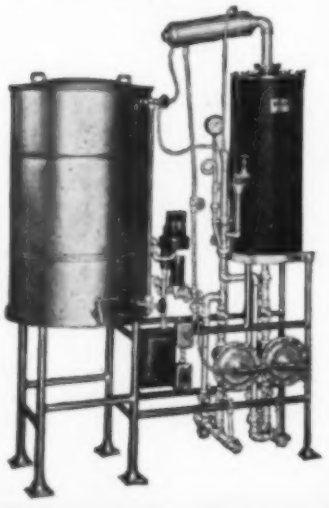


BARNSTEAD DEMINERALIZERS

Barnstead Engineers have developed equipment which utilizes the de-ionizing principle to its fullest practical extent. Conventional 2-bed models as well as the new Barnstead "Double-Action" 4-bed models are available. Both types are available in bench models, portable floor models, and large floor models for permanent installation. In addition, there is the Barnstead Bantam for laboratory use which employs a renewable cartridge and requires no regeneration. Send for Bulletin 112A for complete information and prices.

BARNSTEAD AUTOMATIC WATER STILLS

Noted for their scientifically correct design, Barnstead Stills give trouble-free operation with a minimum of cleaning and attention. Many Barnstead stills sold over a generation ago are still in daily active service producing water far above the U. S. P. specifications. Special types for hard and soft water and for Pyrogen-free distillate for pharmaceutical houses. Models for heating by steam, electricity, gas, kerosene, or gasoline. Ask for new 1947 Catalog "F".



TRADE MARK REG U S PAT OFF

Barnstead STILL & STERILIZER CO. Inc.

4 Lanesville Terrace, Forest Hills, Boston 31, Mass.

is designed to produce either this normal material or a refined product higher in gamma content if there should be a demand for the latter. The product will be offered as technical benzene hexachloride, dry and wettable powder concentrates, and in finished insecticides through the firm's agricultural chemical division.

Rubber Reserve Office Organization Changed

THREE new deputy directors have been named in the Office of Rubber Reserve to assist Gerald B. Hadlock, executive director, in the problems of running the government's rubber business. John T. Cox, Jr., is deputy director on rubber problems; Walter N. Munster is deputy director with responsibilities for monomers such as butadiene, styrene, etc.; and S. D. Morgan is deputy director for distribution arrangements. Research direction continues under O. W. Burke, Jr., in Mr. Hadlock's office.

Armour Building Fertilizer Works in Florida

ARMOUR FERTILIZER WORKS, Atlanta, Ga., has awarded a contract for the design and construction of a building for the manufacture and storage of triple superphosphate to Rust Engineering Co. The building will be located near Bartow, Fla., and will be of structural steel frame with corrugated asbestos roofing and siding. A complete plant site will be developed in conjunction with this project, and a new railroad station known as Armour will be established. The plant will have a capacity of 75,000 tons of triple superphosphate per year.

Witco Hydrocarbon Will Produce Carbon Black

WITCO HYDROCARBON CORP. has been organized to process 15 million cubic feet of natural gas per day from the Barnhart pool in Reagan County, Tex. Two plants are to be constructed. A gasoline plant will produce approximately 2,000 bbl. of gasoline, butane, and propane per day. The residual gas will be burned in the second plant to make channel carbon black which will be marketed by the Witco Chemical Co. These plants will cost about $3,500,000 and completion of the facilities is scheduled for July 1948. The decision was made to build these facilities, in spite of high construction costs, because of the present need for channel black and the increasing demand for butane and propane. Future de-

isn't that the Mathieson Plant?

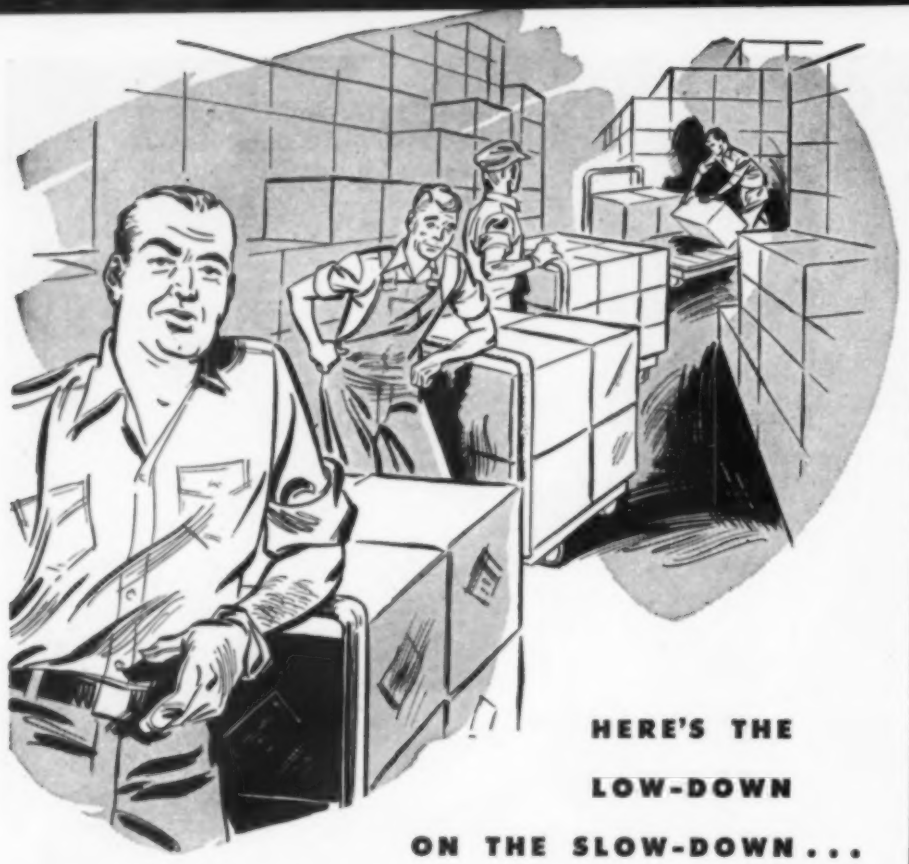
"It's one of them, Mr. Jones—the Niagara Falls plant."

Yes, Mr. Jones and there's another at Saltville, Va., to serve the southeast, and a third at Lake Charles, La., serving the southwest. With three plants, Mathieson offers triple flexibility in deliveries of caustic soda. Call it three sources of supply. That's why weather, breakdowns, railroad or labor conditions seldom keep Mathieson from making prompt deliveries.

The Mathieson Alkali Works (Inc.), 60 East 42nd Street, New York 17, N. Y.

Caustic Soda...Soda Ash...Bicarbonate of Soda...Liquid Chlorine...Chlorine Dioxide Ammonia, Anhydrous & Aqua...HTH Products...Dry Ice...Carbonic Gas...Sodium Chlorite Products...Sodium Methylate.

Mathieson
CHEMICALS



HERE'S THE LOW-DOWN ON THE SLOW-DOWN . . .

There's no mystery about it. It's just that men with loaded trucks simply can't move any faster in crowded aisles and on congested loading platforms. But it's a slow-down just the same . . . and a costly one.

There's no necessity for this expensive loss of time. Two men . . . one at each end of a Rapid-Wheel Gravity Conveyor line . . . can do the work of a dozen men with trucks. They'll keep goods moving smoothly . . . with little effort. If it is going upstairs, couple the line to a Floor-Veyor (an inclined power-belt conveyor). If it's to be stacked, hook on a Rapid-Power Booster. The job will be done in less time . . . for less money . . . with less manpower.

Remember . . . the cost of handling materials, parts, and products runs as high as 30% of total production costs. It's an item that deserves careful thought. We'll be glad to make an analysis of your operations and suggest the proper equipment. There's no obligation.

THE RAPIDS-STANDARD CO., INC.
316 Rapistan Bldg., Grand Rapids 2, Michigan

Your local Rapids-Standard representative is listed in your classified telephone directory.

It's wise to conveyorize

Rapids-Standard
MATERIAL HANDLING EQUIPMENT

velopments may include the processing of the hydrocarbons into various industrial chemicals. The site has been designated as Witco, Tex. Robert I. Wishnick, president of the Witco Chemical Co., heads the new corporation which will operate the two plants, and C. E. McKinney is vice president in charge of operations.

PMMA Elects Officers At New York Meeting

JOHN R. HOOVER, vice president of B. F. Goodrich Chemical Co. and D. S. Frederick, vice president of Rohm & Haas Co. were re-elected president and vice president, respectively, by the Plastic Materials Manufacturers Association, Inc., at its annual meeting. F. H. Carman was elected secretary-general manager and John E. Walker, treasurer.

New members elected to the board of directors are: C. F. Hosford, Jr., Koppers Co., Inc. W. W. Knight, Jr., Plaskon division, Libby Owens Ford Glass Co.; and Spencer E. Palmer, Tennessee Eastman Corp.

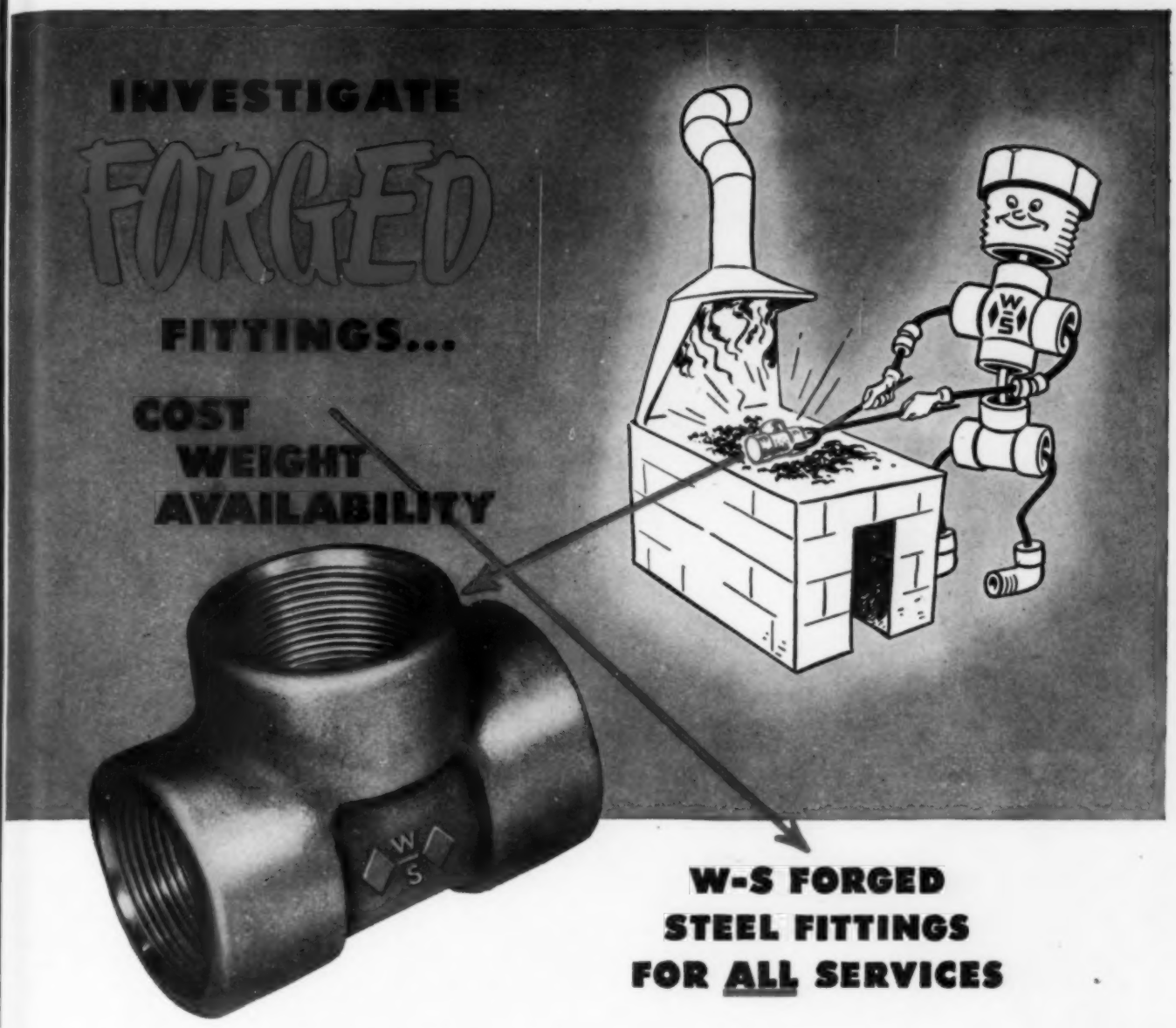
Chemical Development Group Will Meet In New York

THE Commercial Chemical Development Association will hold its annual meeting in New York at the Roosevelt Hotel, March 9 and 10. The business meeting will be held on March 9 and a series of papers will be presented on March 10. Financial aspects of chemical development will be discussed at the morning meeting on March 10. The afternoon session will be devoted to gearing commercial chemical development to sales, research, and manufacturing. It will be followed by dinner at which management's appraisal of commercial chemical development will be given.

Lauren B. Hitchcock, vice president of Quaker Oats Co., Chicago, is president of CCDA; James H. Boyd, consultant, is chairman of the general program committee; and John B. Calkin, coordinator of research, Union Bag & Paper Corp., New York, is chairman of the meeting.

Technical Societies Council Holds Dinner in Cleveland

SECOND annual banquet of the Cleveland Technical Societies Council was held January 26 at the Hotel Carter. Philip D. Reed, chairman of the board of the General Electric Co. was principal speaker. Sponsored by more than 50 major industries in northern Ohio, the banquet has been established as the annual joint social



W-S FORGED STEEL FITTINGS FOR ALL SERVICES

Now is the time to consider W-S forged steel fittings for *all* services.

The price differential between forged fittings and cast types is less than ever before. Remember, too, that tough, accurately machined, *forged* steel fittings pay for themselves many times over in greatly reduced maintenance and down-time. Service life is phenomenal. Just put them in and forget them.

Of course, you'd expect *forged* fittings to be stronger, but did you know that, service for service and size for size, they are smaller and lighter in weight than most cast types having only a fraction of their pressure rating?

W-S distributors are located in principal cities. Consult the one nearest you about the use of stronger, lighter, cost-saving Forged Fittings for *all* services. They're available for quick delivery.

WATSON-STILLMAN

ROSELLE, NEW JERSEY

1848—CENTENNIAL—1948

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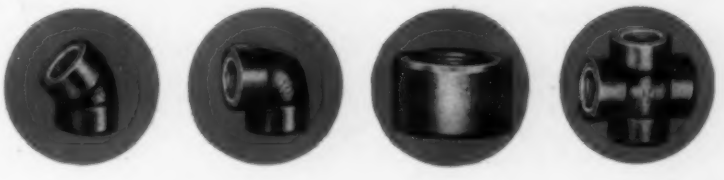

4070

PLAY SAFE ... specify CATAWISSA

there is a difference!

NEW PLANT OR OLD...

Catawissa UNION and VALVE dependability means LOWER MAINTENANCE COSTS ... with an EXTRA margin of safety!

HOT FORGED STEEL AND STAINLESS STEEL UNIONS

STANDARD
1/8" TO 3"
Cold-Working Pressure up to 2,000 pounds.

DOUBLE EXTRA HEAVY
1/8" TO 2"
Cold-Working Pressure up to 6,000 pounds.

The Catawissa seat design gives you a perfect seal for every installation -- even when the pipe is not properly aligned -- with its 55-degree angle on the female end to a ball on the male end!

HOT FORGED STEEL SWING CHECK VALVES.
ESPECIALLY ADAPTED FOR HIGH TEMPERATURE & HIGH PRESSURE SERVICE!
For boiler injection--engineered to outlast the boiler! Efficient, easily accessible!

See your industrial supply distributor -- or write direct for a copy of BULLETIN 10-A

CATAWISSA VALVE & FITTINGS COMPANY
100 Mill Street
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CATAWISSA
UNIONS ★ VALVES

function of the 35 engineering and technical societies in the Cleveland area. They have a membership of 10,000. Serving as toastmaster was Leonard C. Weitz, president of Independent Explosives Co., Cleveland. George R. Canning of the Ohio Bell Telephone Co. was chairman.

International Expanding Its Carlsbad Potash Refinery

As another step in its long-range program of entering new industrial markets, International Minerals & Chemical Corp., Chicago, plans a plant addition costing over $1,000,000 at its Carlsbad, N. M., potash refinery. Two new chemicals will be produced: chemical-grade muriate of potash and an improved-grade potassium sulphate. A new and efficient extraction process has been developed and special equipment has been designed. In addition, present facilities will be improved with resulting higher recoveries and increased capacities for all existing grades of potash salts. Preliminary layout design is being handled by Western-Knapp Engineering Co., San Francisco. Construction will be started as soon as possible and completion will probably take place within a year.

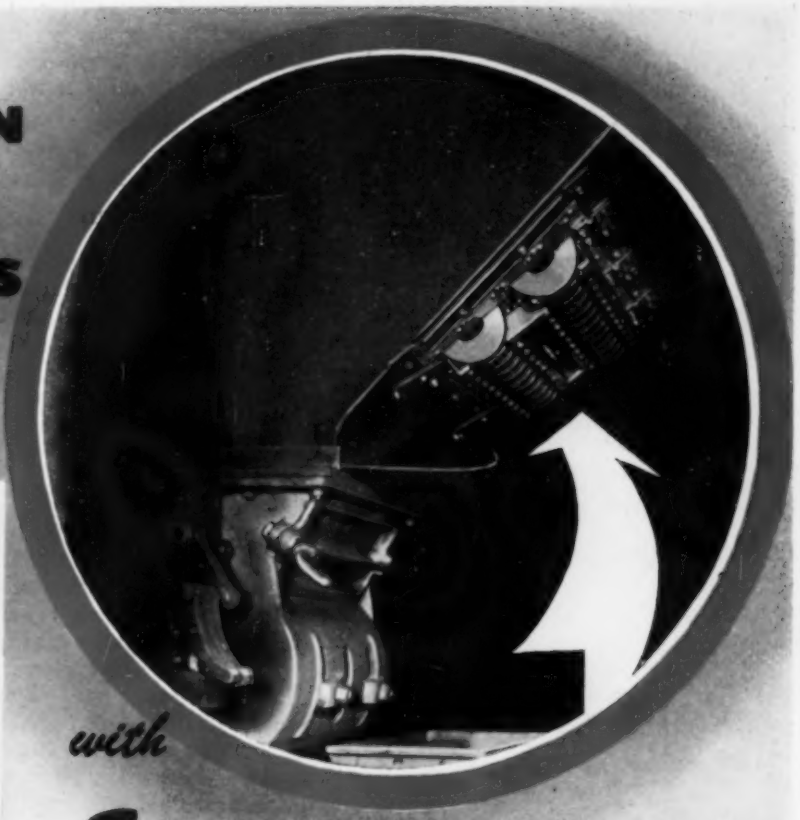
One of four major potash producers in the country, International at present markets two grades of muriate of potash, sulphate of potash and is the only producer of sulphate of potash-magnesia. With the new output of a chemical grade of potash, the company will serve industrial users in the potassium chemical field. This chemical will also be used as the principal raw material for the firm's own potassium chlorate plant near Cincinnati, Ohio. The improved-grade of potassium sulphate will be made available for fertilizers as well as to present consumers.

Hydrochloric Recovery Unit Planned at Tin Smelter

Facilities to the extent of $2.7-million to recover hydrochloric acid and other materials from an enormous accumulation of waste liquor at the tin smelter near Texas City, Tex., have been authorized by the Reconstruction Finance Corp. The action became necessary as the result of the mounting size of the accumulation, some of which recently got into local tidal waters and caused the destruction of fish, according to Texas conservation authorities.

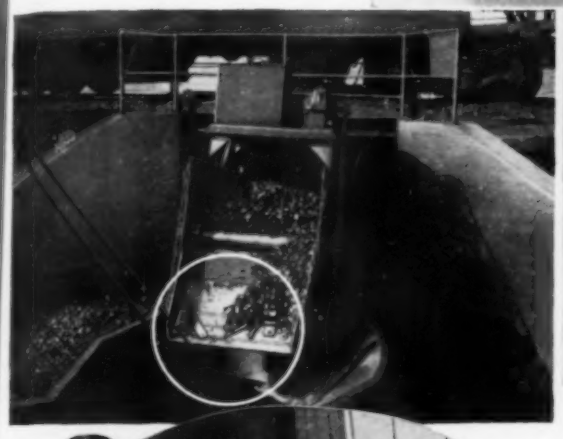
A plant official says that it is believed the recovered acid will be sufficient to meet the entire acid re-

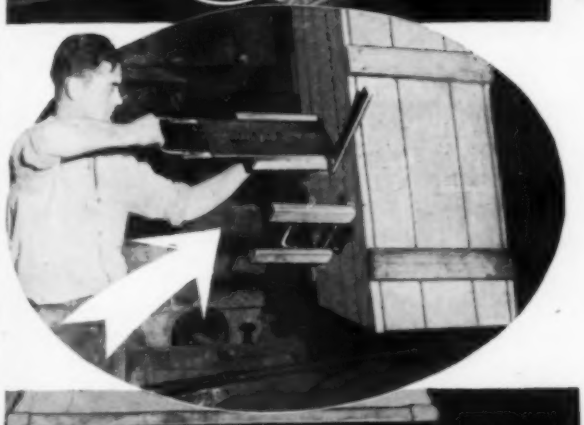
Stop TRAMP IRON *Before* TROUBLE STARTS



with

Eriez NON-ELECTRIC *Permanent* MAGNETS





HERE is diversity which is typical of Eriez Non-Electric Magnetic Protection operating in all kinds of chemical and industrial processing lines. Regardless of the magnetic separation requirement or materials being processed, there is an Eriez unit to do the job. The powerful magnetic field of the permanently magnetized Eriez prevents the passage of even the smallest particles or the largest pieces of tramp iron. Moreover Eriez Magnets eliminate costly explosions, damage to machinery and assure purity of product.

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Dear Sir: We are interested in removing tramp iron or ferrous particles from the following materials: .....

We would like to know more about installation of ERIEZ on: CE-2

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quirements of the smelter. Chemical Construction Corp. is the contractor for the work, which will be completed late this year or early in 1949.

New Paint Firm Begins Production at Gulfport

A NEW Mississippi firm, Gulf Paint & Chemical Co., has opened a $75,000 plant at Gulfport, Miss., and initially will manufacture industrial finishes. It is planned ultimately to manufacture a complete line of paints and enamels. The company will produce house paint vehicles, varnishes and grinding liquids. The plant includes laboratory space and equipment for control and development. C. E. Holcomb is general manager and V. R. Sullivan is technical director.

A course in Chemical Engineering Administration will be presented by the Polytechnic Institute of Brooklyn during the coming spring term.

READERS' VIEWS AND COMMENTS

Author Protests

To the Editor:

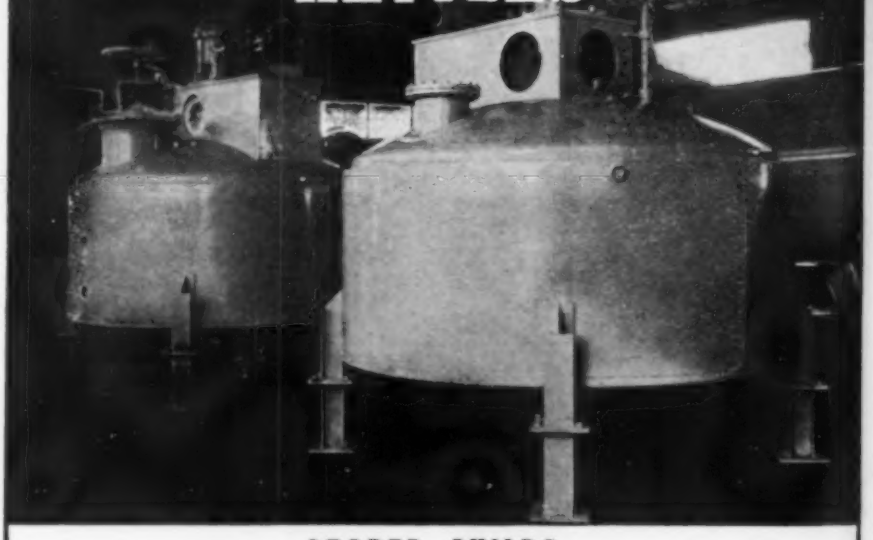
Sir:—In earlier correspondence regarding my book, "Treason's Peace," and the review which I was nagging you to write, I finally challenged you to go over it "word by word and then list the statements of fact which you can disprove and the number of official records which you can prove are not quoted correctly. Then, write your review and God bless you!"

I wrote that challenge as an old friend. Having just received a copy of the review in your November issue, I can but regret that you have not accepted my challenge but instead have indulged in generalizations accusing me of intemperance and distortion, without citing a single passage in the book to support these allegations.

I will pass by the sneers at my motives, my war record and my industrial achievements, with the comment that "What the hell do these have to do with the factual accuracy of the official records which are assembled in this book?"

However, for the record, I should not ignore serious misstatements of fact which are in your review and which might cause your readers to believe that the book contains allegations about certain individuals and com-

AGITATED JACKETED KETTLES



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Where the hazards of individual gases or combinations of gas, smokes, vapors or dusts are potential in your operations, the specific protection of M.S.A. Industrial Gas Masks affords desirable respiratory safety for your workers. A complete range of long-lived, replaceable canisters is available, enabling you to match *specific protection to specific hazards.** Featuring the famous M.S.A. All-Vision Facepiece, for wide-angled vision and comfortable gas-tight seal on face, the Masks are quickly applied and do not hamper working freedom. Write for full description and list of gases for which protection is afforded, in Bulletin No. ED-11.

For respiratory protection against specific gases or groups of gases, with interchangeable canisters.

* Carbon monoxide and illuminating gas excepted. See M.S.A. All-Service Gas Mask below.

M·S·A

ALL-SERVICE Gas Mask

Providing respiratory protection for the worker against combinations of carbon monoxide and all other poisonous industrial gases, vapors and smokes with a single, replaceable canister, the famous M.S.A. All-Service Gas Mask meets *any* respiratory emergency in the plant, wherever a canister mask can be used. Officially approved by the U. S. Bureau of Mines, the All-Service Mask is available in Standard Model with regular canister, and Model S equipped with canister containing a special filter for added protection against toxic dusts, mists, fogs and smokes. Both models feature the M.S.A. All-Vision Facepiece, can be put on and adjusted rapidly, and provide excellent wearing comfort. Bulletin No. EA-8.

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panies named by you, which the book most certainly does not contain.

For example, at the beginning of the review it is alleged that the author charges criminal connivance with the "I.G. monster" of his list of "more than 250 chemical and allied companies." This is a deliberate misstatement. My "list" in the appendix of companies having relations with Farben is preceded by the explicit statement that it had been "compiled solely to illustrate the width and depth of Farben's penetration in American industry," and that "Identification here as was stated at the end of Chapter IV does not imply impropriety or illegality" in relations with the I. G. Farben by the company thus named.

Again in your list of names of individuals and companies with which you ask your readers to compare with my own war record and industrial achievements, you name Dow, Merck, Pope, Sadler and Sharpless, as included by me among the "American dupes—whether knaves or fools."

I assert emphatically that you cannot sustain these allegations by referring to the book itself. The Dow company is specifically absolved for its magnesium tieup with Farben, as the victim of a "shotgun marriage" forced on it by threats and conspiracy, and the senior Dow was lauded for defying the German dye trust during the World War I prewar years.

Merck & Co. was mentioned just once as having been given a contract for the laudable purpose of supplying atabrine when Winthrop first fell down on this, as a result of the Sterling-Winthrop-Farben conspiracy. There was not the slightest reproach implied to Merck in this reference.

Your reference to Pope must refer to Col. Frederick Pope who is named by me as a director or official of more than one of I. G. Farben's American affiliates. With my specific statement that he is named "without questioning Mr. Pope's high standing as an industrial engineer, or the good faith of his recommendations, etc."

E. J. Sadler and Sharpless Chemical Co., alleged by you as accused by me are both mentioned in the book quite casually and without the slightest implication of impropriety on the part of either.

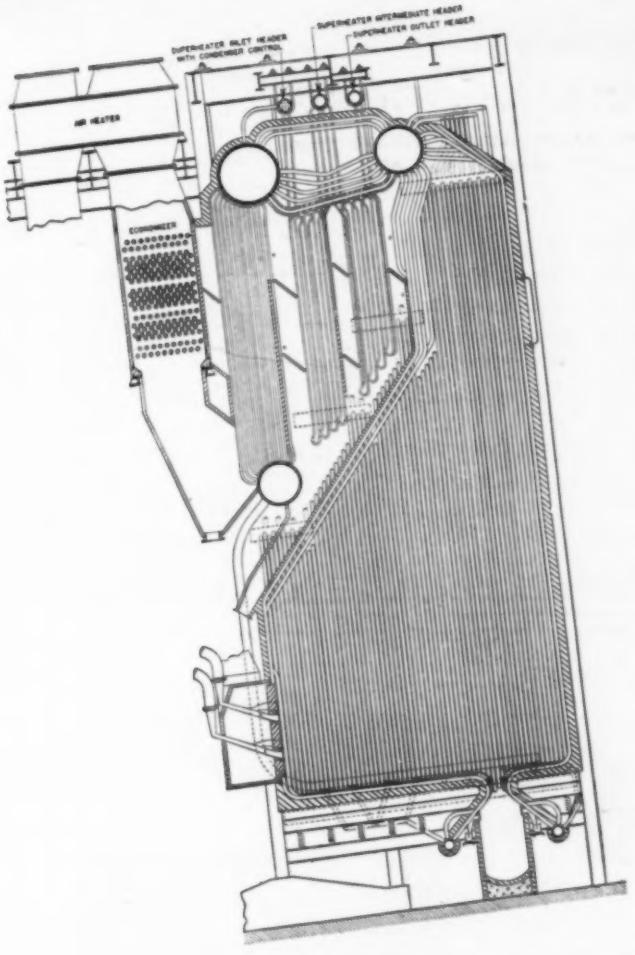
It would appear that these allegations in your review, that I accuse each and every individual or company named in the book of wrongdoing is in the familiar technique of attempting to discredit by indirection the facts which I cite from official records and which do in themselves accuse certain important individuals and corporations.

I suggest that this technique is un-

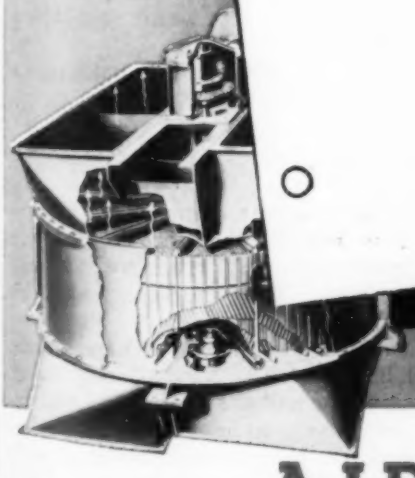
ENGINEERING PROGRESS REPORT #18

LJUNGSTROM AIR PREHEATER

A MIDWEST POWER PLANT



Here is another application of a Ljungstrom Air Preheater to a Foster Wheeler boiler.



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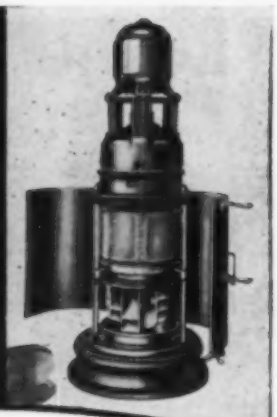
Executive Offices: 60 East 42nd Street, New York 17, N. Y. • Plant: Wellsville, N. Y.

Users Report 50 to 80% Time Saved and Greater Recovery in Sifting



Abbé-Blutergess Turbine Sifter

- "We sift 9600 lbs. of face powder against 1800 lbs. from gyrator per 8-hour day in less floor space at lower cost."
- Replaced large bolting reel. Report: "90% fines; twice as fast; overhead cut 50%."
- On pharmaceutical powders, "We save ½¢ to 2½¢ per lb. and sift 3 to 4 times faster than with other mechanical sifters we replaced."
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Let us test your product free and submit report on what the Abbé-Blutergess Turbine Sifter can do for you. Catalog 52.

Upper Left — No. 1 Single Turbine Sifter; capacity to 1000 lb./hr.; portable; floor space 2′ x 2′4″. Right — No. 2 Double Turbine; showing lower screen removed; capacity to 10,000 lbs./hr.; diameter of base only 25½″.

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worthy of you and your publication. Perhaps the most unworthy sneer in your review is that in which you accuse me of implying that I am the only man who has always been right, patriotic and unselfish, etc. Why, may I ask, does your review fail to mention the many passages in "Treason's Peace" which praise to the skies men like Frank Garvan, Herty and the others who, in the early days after World War I, warned you and other American citizens of the future intentions of the German dye leaders; and the repeated tributes which my book pays to many other individuals in and out of government service, such as Baruch and Morgenthau, for the parts they played in attempting to expose and defeat the criminal conspiracies of Farben and its American allies during World War II.

I might overlook some of the other misstatements in your review as possible carelessness, but your effort to make it appear that my book fails to give others any credit for their attacks on Farben and instead heaped false praise upon myself, is as cowardly as it is unworthy.

I repeat my challenge that you cite the specific passages in the book which you believe to be false or inaccurate. It so happens that after all of the threats of libel suits which delayed publication of this book for years while some forty firms rejected the manuscript (and while fantastic sums were being suggested to me should I consent to suppress it and keep my damn mouth shut) since it appeared there have been neither libel suit nor demand for retraction from a single one of those named in it—nor to my knowledge a single inaccuracy pointed out by anyone.

I suggest that a retraction is in order, for the unsupported sneers and misstatements with which your review is made up.

HOWARD W. AMBRUSTER
Westfield, N. J.

Reviewer Responds

MY PERSONAL opinions and impressions reported in this review were based on a careful reading of this bitter book. That they are shared by other readers is evident from many commendatory letters and comments I have received. My only purpose in citing the author's background and experience was to help the reader understand the viewpoint and authority with which the book was written. I did not intend that my mention of the list of 250 chemical and allied companies in the book's appendix should refer directly to the author's indictments of individual Americans for criminal con-

How DE LAVAL "Nozzle-Matic" BOWL

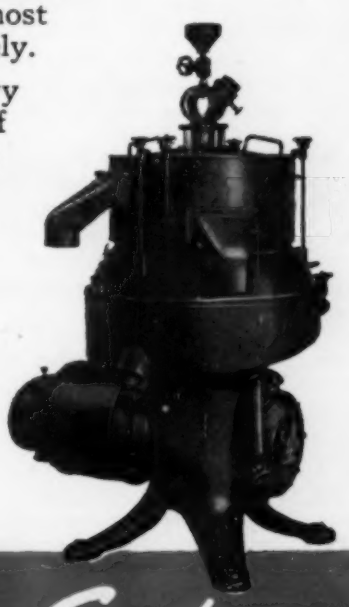
EFFECTS CONTINUOUS 3—WAY SEPARATION

THE DE LAVAL "Nozzle-Matic" makes many processes continuous that once were slowed down by gravity settling or by other less effective means of separating and clarifying two liquids.

The liquid mixture is piped into the bowl and divided into thin layers by the discs. This thin-layer distribution enables centrifugal force to act on the mixture most effectively and thus separate the liquids most completely.

Finely divided solid matter and some of the heavy liquid is continuously discharged through nozzles of unique design into the bottom discharge cover. The remainder of the heavy liquid discharges into a middle discharge cover, and the light liquid, usually the valuable product, discharges from the top cover.

The capacity of the "Nozzle-Matic" is high—up to 6,000 gallons per hour or even more. Write for Bulletin IN-1.



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DE LAVAL *Processing Systems*

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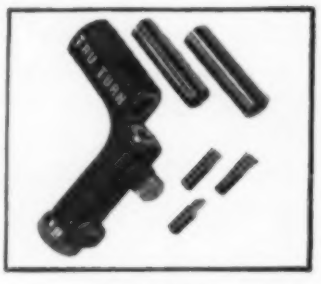
A new tool called "Tru-Turn" makes possible the conversion of drill presses, woodturning lathes, or grinder stands into tools that will turn and cut-off steel, bronze, copper and aluminum. The "Tru-Turn" tool shown above is mounted on a Buffalo Drill Press, Spindle Size.

The "Tru-Turn" tool is easy to operate and cuts and turns bar stock of steel, bronze, copper and aluminum measuring ¼", ⅜" and ½". Its built-in micrometer permits adjustments that give tool-room accuracy of 1/1000 of an inch.

Small tool shops as well as all types of repair shops and garages find the "Tru-Turn" ideal for cutting long pieces of bar stock into desired lengths. Also, home craftsmen are able to produce accurate, highly finished precision-machined parts from metal even without previous training.

Accurate, precision work is also easier to do when tension is relieved by chewing gum. The act of chewing seems to make the work go easier, faster—thus helping on-the-job efficiency. For these reasons Wrigley's Spearmint Chewing Gum is being made available more and more by plant owners everywhere.

You can get complete information from Millholland Screw Products Corp., 132 West 13th Street, Indianapolis 2, Ind.



Tru-Turn Tool

AC-56

nivance mentioned in the preceding paragraph. I was well aware that he had hidden those weasel words and phrases in the several paragraphs that headed his list.

My list of individuals was, as indicated, merely a rambling sample of the hundreds of names in the alphabetical index. I had in mind the dubious honor of being cited along with "fools and knaves" in a book carrying as its sub-title "German Dyes and American Dupes." Perhaps I was in error in failing to associate Howard Ambruster with the late and great Francis P. Garvan and Charles H. Herty or with Edgar Fahs Smith "whose attainments were recognized the world over and whose probity not even a Senate Committee could attack."

Finally, we stand on our statement "that while we disagree with much that Mr. Ambruster says—and much more that he implies—we are glad to live in a world where he has the right to say it." And we would remind Mr. Ambruster that he shares those rights with others—including this reviewer.

S. D. KIRKPATRICK

Including the Scandinavian

To the Editor:

Sir:—I have studied with great interest the report on "The Marshall Program" which was published in the December 1947 issue of *Chemical Engineering*. It is by far the best report I have seen on this important subject.

It seems to me that it would be a very good idea to make this report available to the management of Norwegian industrial companies, as it would assist the key personnel in the Norwegian industry in understanding the implications of the Marshall program on the economy of the United States, and in understanding America's capacity to assist Europe at this time. I therefore ask you whether you would permit a Norwegian translation of this report to be published in the monthly publication of the Federation of Norwegian Industries.

JAN H. REIMERS
Norwegian Industries Commission
New York

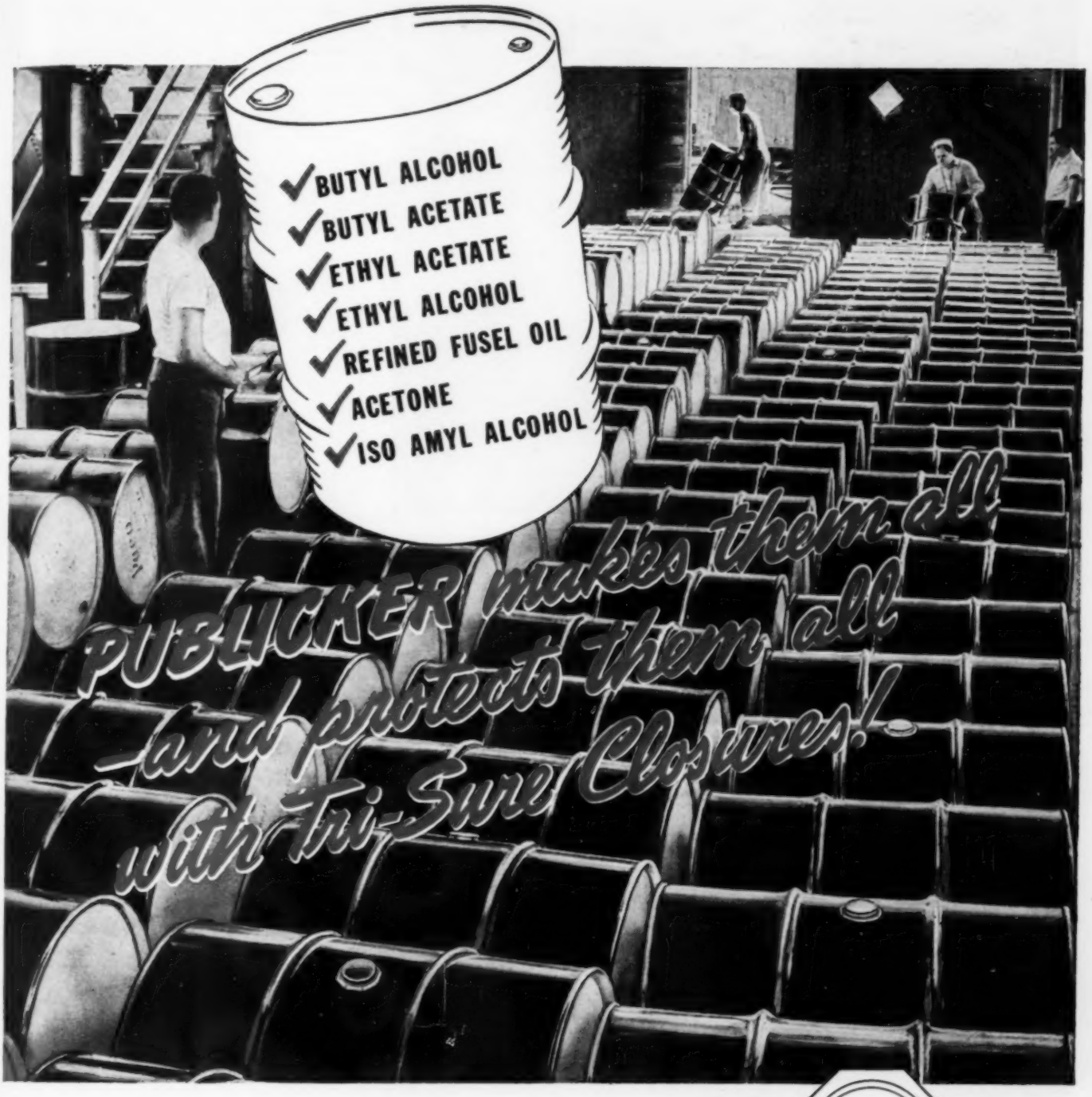
Permission was granted, of course, provided acknowledgement of source was made.—Editor.

15-Year Scoop

To the Editor:

Sir:—We have noticed a lot of the newspapers in recent months carrying a news item about rain making with the use of Dry Ice.

We get news clippings from a London agency from newspapers all over



To countries all over the world — including Australia, New Zealand and China as well as Europe — go shipments of alcohol and solvents from the plant of Publicker Industries Inc., one of the world's largest producers of alcohol and solvents.

Customers in scores of countries rely on Publicker quality in butyl alcohol, butyl acetate, ethyl acetate, acetone, refined fusel oil, iso amyl alcohol, and the famous Thermo Anti-Freeze. And customers know they can be sure that every gallon that Publicker ships will be *delivered* exactly as specified — because *every Publicker product is packed in drums equipped with Tri-Sure Closures*.

Publicker Industries Inc. — like most leading shippers of liquids — has found that only the *best protection* is good enough for fine products. And their experience as one of the world's foremost drum users has proved that the best protection — from leakage, seepage, contamination and substitution — is provided by *Tri-Sure Closures*.

Tri-Sure
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CLOSURES

Tri-Sure Closures have a *seal* that cannot be removed unless it is deliberately destroyed, a *plug* that is held tightly in place, and a *flange* which is always flush with the inside of the drumhead—assuring complete drainage.

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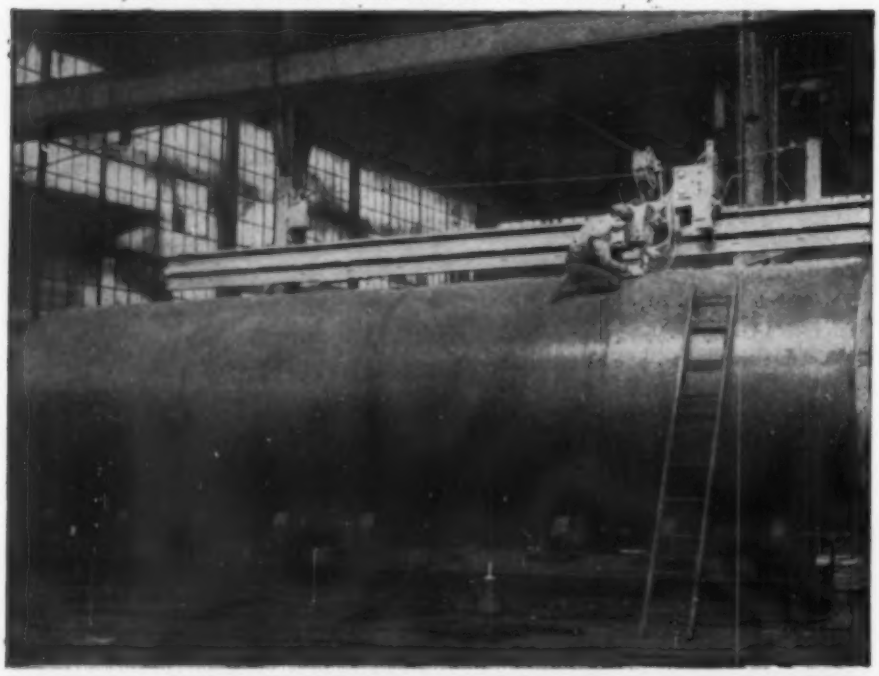
MADE RIGHT AN INGALLS BIRTANK PRODUCT **WELDED TIGHT**

● *Overhead automatic welding machine gives smooth, leak-proof seal to shell seams as tank revolves slowly on rolls.*



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the world and have received more than 100 such clippings. It would seem that this is recent news, but I would like to direct your attention to the February 1933 issue of your magazine, page 79. It looks as though you had a 15-year scoop on this as news.

W. W. White
International Carbonic Engineering Co.
Wilmington, Del.

Author Takes a Bow

To the Editor:

Sir:—I had forgotten the published reference, and when asked whether I had ever heard of the idea, I remembered exactly when it first occurred to me, but had no recollection that there was any publication. It happens that I attended the ACS meeting—I believe—1923 in Washington, D. C., and after the meeting attended a demonstration of a number of things staged by the CWS at Edgewood Arsenal. You were very probably present, I don't recall whether you were or not. At any rate, they showed the use of silicon tetrachloride to produce a smoke screen, and I remarked to Dr. E. R. Harding and Dr. Edgar Clark of Mellon Institute who were with me that it would be interesting to take a cylinder of liquefied carbon dioxide or some carbon dioxide snow ("Dry Ice" as a trade mark being then unknown and unregistered) up in a plane and find out whether one would get rain, snow, or just a fog screen. Nothing was done about it at the time, and some years later I now recall I did include mention of the same suggestion coming from someone in Europe in my article published in your February 1933 issue.

Charles L. Jones
266 South High Street
Columbus, Ohio

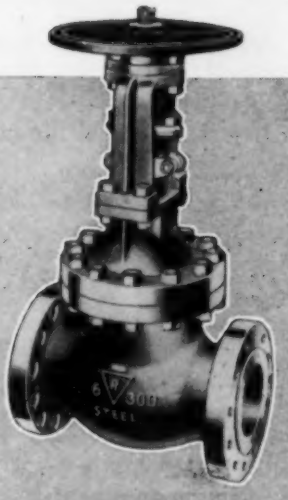
Thanks From Finland

To the Editor:

Sir:—I have been informed by Mr. A. Morgan, member of the American Friends Service Committee, that he asked you to publish in *Chemical Engineering* a small article on our Institute of Technology and the contribution to its library. As the president of our Institute of Technology, I beg to express our best thanks for your kindness.

Ours is the only Institute of Technology in Finland for preparing graduate engineers and architects of the highest degree for different technical branches. As the paying of war indemnities as well as the reconstruction of the country are making very great

"VALVE MEN" LIKE R-P&C VALVES



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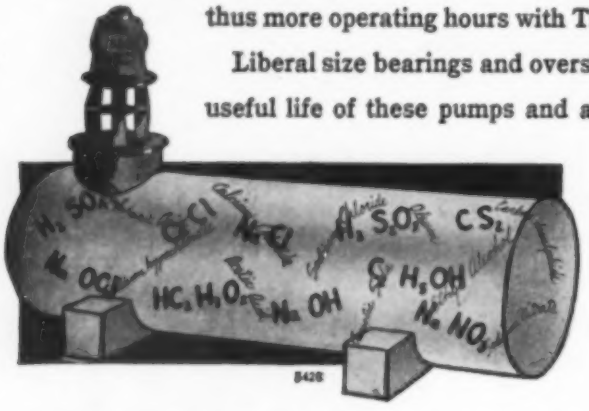
Liberal size bearings and oversize shafts extend the useful life of these pumps and also retard vibration.



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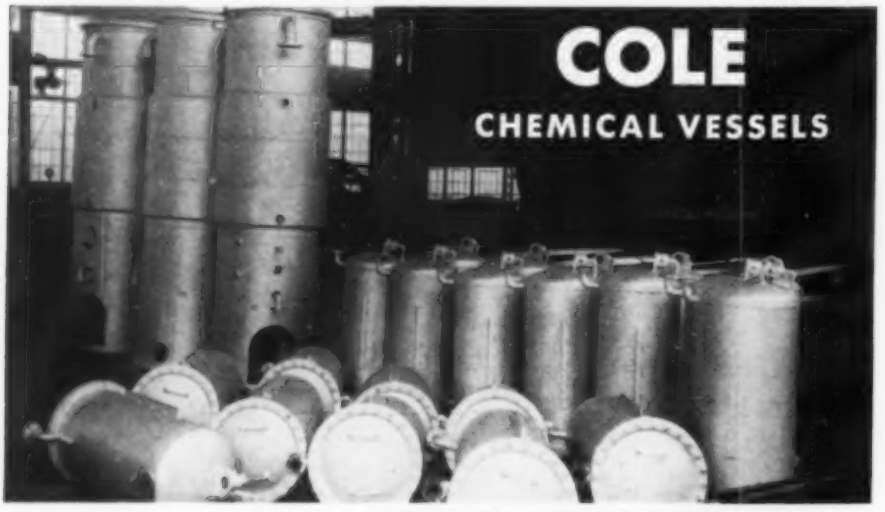

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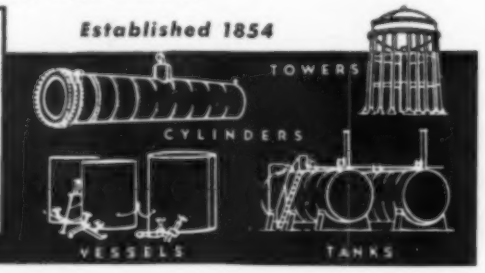

and increased demands on our industrial activities, the demand for graduate engineers and architects has been multiplied in the years after the war. To meet this demand the Institute has been obliged to highly increase its production of engineers and architects, at the same time endeavoring to maintain the quality of teaching on the most high standard. The present enrollment at the Institute of Technology is about 2,000. Nearly 400 new students are matriculated every year which means that the annual number of graduated engineers and architects is about three fold to the corresponding number before the war.

During the war out Institute of Technology was twice very severely bombed. At the second bombing our library, comprising about 80,000 volumes, was completely destroyed. We have now begun to rebuild our library both through purchases and donations and it contains about 40,000 volumes already. It is our purpose to create a technical central library for the use of the Institute of Technology as well as the research institutes and the industry. However, the difficulties in getting foreign funds highly prevent the acquiring of foreign literature and periodicals. We are therefore very appreciative for the contributions we receive.

MARTTI LEVÓN
President
Teknillinen Korkeakoulu
Helsingissä

Did *You* Like It?

To the Editor:

Sir:—One feature in particular that I liked about the December issue of *Chemical Engineering* was that it was bound without the use of metal staples. I feel sure most of the readers will consider this an improvement for the magazine now lies flat when opened and as a consequence is much easier to handle and to use. This feature is also of interest to me from another point of view—it is now much easier for me to remove articles of special interest for inclusion in my personal reference files.

Please allow me to comment briefly about this latter point. For a number of years, like many chemists and engineers, I saved all my scientific journals and magazines. However, I soon found that the publications accumulated too rapidly and took up too much space. I decided, therefore, to disembowel each magazine—after all the articles had been passed over, scanned or read and all the advertisements checked—and to save and file only those articles that were of special interest to me. As a result, I was able

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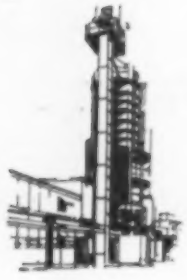

AT PAULSBORO, N. J., on the Delaware River, the Socony-Vacuum Oil Company accomplished another war-time miracle when it erected and put into operation, within six months from breaking of ground, a plant for the manufacture of a synthetic catalytic agent needed for the refining of high-test aviation gasoline.

This catalyst consists of tiny beads, the raw materials of which include sodium silicate, sulphuric acid, aluminum trihydrate and river water which has been demineralized and then degasified, under vacuum, in a Cochrane Cold Water Deaerator.

Numbers of Cochrane Cold Water Deaerators were also used in the Manhattan Project. They are worth investigating for problems similar to these.

The water, when taken from the Delaware River, is saturated with oxygen and contains up to 50 ppm of carbon dioxide. After demineralization it passes to the Cochrane Cold Water Deaerator, where, at a minimum temperature of 35°F. and under perfect vacuum conditions, the dissolved oxygen and carbon dioxide are completely removed at 1650 gallons per minute.

COCHRANE CORPORATION
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COCHRANE DEGASIFYING EQUIPMENT

to reduce my accumulated mass of literature to about 10 percent of its original volume. The only troublesome feature of this system was the evisceration of each magazine, especially thick magazines like *Chemical Engineering*. But now that the staples have been removed, even that is an easy job. Therefore, I raise the question—why can't the staples be left out permanently?

I wonder how many of the readers of *Chemical Engineering* will agree with me—for one reason or the other—that the staples should be left out?

FRANK A. ANDERSON
Acting Head
Department of Chemistry and Chemical Engineering
University of Mississippi
University, Miss.

It is planned to continue this so-called "perfect" type of binding.—Editor.

He Likes It

To the Editor:

Sir:—Two comments which might interest you: (1) I liked the new manner of assembling the December issue with glue instead of wire fasteners; it makes it much easier to tear out pages for my files. (2) Since I remove articles of lasting interest I would prefer to see all articles start on the odd-numbered pages. (I am familiar with your reasons for not doing so.)

CHARLES W. HAWLEY
Stamford, Conn.

(1) See above. (2) Admittedly desirable, but impractical under present conditions.—Editor.

Correction

A NUMBER of errors have been called to our attention in the article: "How 'N' System Simplifies Piping Cost Calculation," by R. A. Dickson, which appeared on pages 121-123 of our November 1947 issue. A drafting error in copying Mr. Dickson's originals resulted in inadvertent doubling of the abscissa scales for Figs. 3 and 6, which should read from 0 to 12, rather than from 0 to 24. In Fig. 5 there is confusion over the "series" number of the valve and flange referred to. One leading valve manufacturer uses "series 15" for 150-psi. service and "series 150" for 1,500-psi. service, while another leading manufacturer uses "series 150" and "series 1,500" for the same pressures. The author intended to use the latter system. The specification for Fig. 4 is therefore correct, but for Fig. 5, series 1,500 flanges and valves should have been specified, rather than series 150.

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You're looking at a danger spot in industry—the spot where two gear teeth come together. That white line shows the contact area where pressures build up, sometimes to thousands of pounds per square inch.

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The filter does not require opening up during operation, being controlled over the entire filtering cycle by external valve manipulation. This permits handling volatile liquids with negligible losses—reduces danger to the operator from corrosive liquids—allows insulation of the entire filter for operation at high or low temperatures. Important economies in installation cost, operating labor and cloth replacement costs result from the closed cycle operation.

The extremely compact design requires a minimum of cubic footage of building space for installation of the filter surface required.

Write for a copy of Bulletin No. 105 which gives more information on this new filter.

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NEWS FROM ABROAD

Special Correspondence

McGRAW-HILL *World News*

Wartime explosives plant in Scotland to be converted for production of pentaerythritol . . . Canadian firm surveys field for aluminum project in New Zealand . . . Poland to expand output of nitrogenous fertilizers . . . Australia builds wood distillation plant modeled after that of Crossett Chemical Co. . . . Salt works ready to open in Alberta, Canada . . . Lever Bros. plans soap plant for British Malaya . . . Larger chemical production in nationalized sector of Czechoslovakia . . . Strikes reduce French chemical activities

Pentaerythritol To Be Made in Scotland

AN UNOFFICIAL report says an explosives plant at Powfoot, Dumfriesshire, Scotland, is being converted by Imperial Chemicals Industries, Ltd., to the producton of pentaerythritol. This material is being used extensively in Great Britain in the paint industry and in replacing glycerine and other scarce materials. Imperial Chemical Industries has made several conversions in Scotland under its policy of adapting wartime facilities and products to peacetime uses.

New Zealand Considers Aluminum Project

ALUMINUM LTD., of Canada, is negotiating with the New Zealand government on a combined hydroelectric development and aluminum refining project in which the Canadian firm would participate to the extent of £NZ10 million ($32,000,000).

Canadian hydroelectric experts are in the South Island for an exploratory survey. The project envisages production of 50,000 to 60,000 tons of aluminum a year from a power plant capable of delivering 6,500 million kwh. annually.

While the dominion's hydroelectric potential is considerable, New Zealand is less well placed for coal—essential in preparing alumina from bauxite—and there are no known commercial deposits of bauxite.

A smaller Australian project, also originally involving Aluminum Ltd., has made little headway. The Australian government is receiving technical advice on the design of the plant from the Dorr Co., of New York. The plant, of 10,000 tons capacity, is to be located in Tasmania and will be designed to operate on low-grade Australian bauxite.

Chemical Industry in Poland

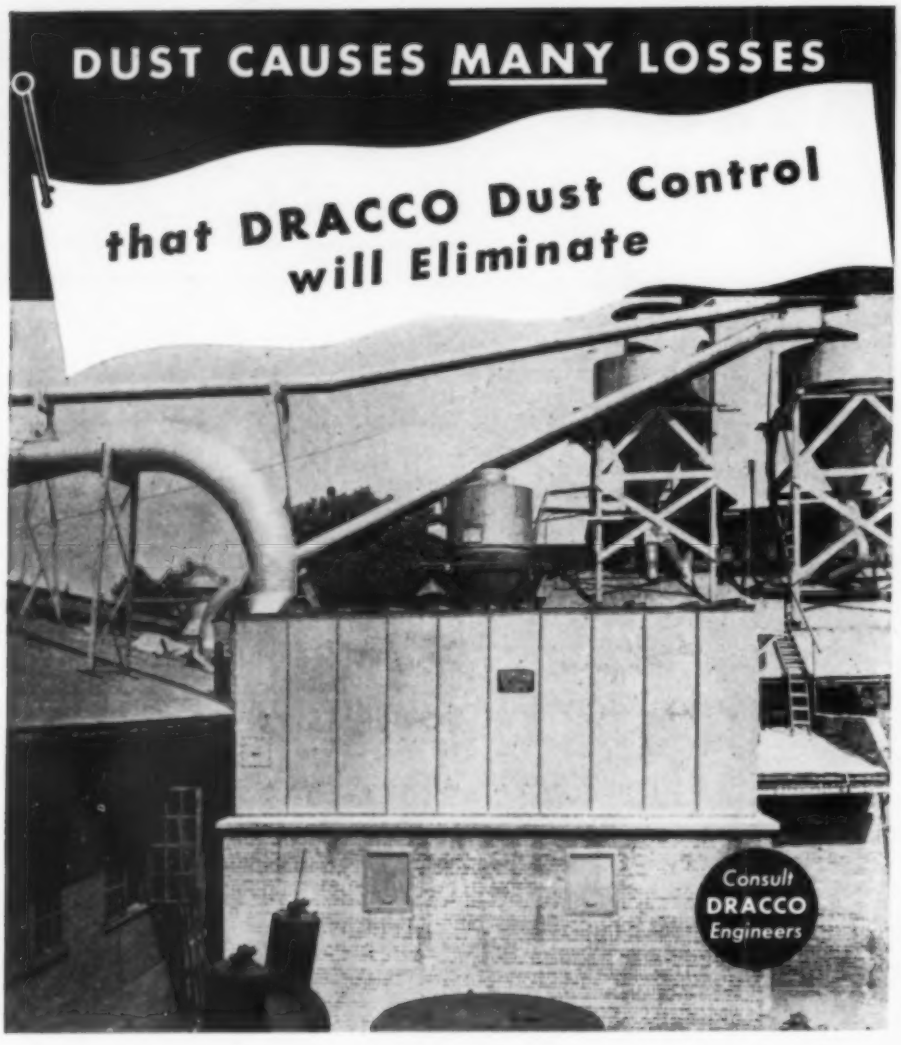
POLAND is seriously considering the development of its chemical industry which had been badly neglected before the war, according to the French publication *Chimie et Industrie*. In the course of the next few years the production of nitrogen fertilizers should reach a minimum of 160,000 tons per year, as compared to the few ten thousands of tons before 1939. The plant of the Etat des Compozes Azotes of Warsaw has exceeded its prewar production and is the largest producer of nitrogen compounds. Poland is going to undertake the exploitation of new deposits of phosphorite located at the mouth of the San river and on the two banks of the Vistule. There are seven superphosphate plants, three of which are actually in operation. The other four will be started soon. Poland is also in a position to mine potassium salts in the vicinity of Inowroclaw. A study is being made of the possibilities of rapid reconstruction of a number of plants resulting from the chemical industry (electrodes, synthetic oil, etc.).

Wood Distillation Plant Building in Australia

MODELED after the plant of the Crossett Chemical Co., Crossett, Ark., a new structure is going up at Wundowie, 41 miles east of Perth in Australia. It will cost $1,000,000 and its main objective is to produce pig iron for local foundries but proceeds from the sale of byproducts are expected to contribute 50 percent of its total income.

The enterprise is based on the use of byproducts from a nearby sawmill. Commercially valuable logs will be sold as timber and only offcuts and waste will see the interiors of the carbonizing retorts. Primary product of the charcoal retorts will be 10,000 gal.

BLAST FURNACE and byproducts refinery now nearing completion at Wundowie, Western Australia, to supply pig iron for local foundries. Methyl alcohol and other byproducts, however, are expected to contribute half of the plant's income



Dust must be reckoned with because it reduces plant efficiency and causes dollar losses in so many ways. High speed production and harder materials have created dust hazards in many plants that formerly were dust-free. Don't ignore a dust condition even though the amount is small — any dust will cause losses. DRACCO Dust Control is used in thousands of plants in all parts of the world to eliminate dust and fumes. DRACCO Engineers have over 30 years experience handling dust problems of every description — why not consult them?

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DUST CONTROL EQUIPMENT
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a day of pyroligneous acid which will be piped to a distillation unit designed by the Vulcan Copper & Supply Co., of Cincinnati.

Principal products of the distillation unit will be acetic acid, methanol, and related products. Australia's present production of acetic acid runs around 1,500 tons a year which will be increased by 350 tons of glacial and 150 tons of technical grade. The plant will be able to produce one or several products from the methanol fraction to suit market demands. These include chemically pure methanol, methyl acetone, denaturing grade naphtha, 95 percent solvent grade naphthol, and 40 percent allyl alcohol. A likely combination is chemically pure methanol, methyl acetone, and allyl alcohol. Australian methanol production is estimated at 900 tons a year and the new plant will add 220 tons.

Toilet Preparations Still Controlled in England

Owing to the continuing scarcity of tin and glass containers, paper and board and certain other raw materials, the Board of Trade in England has decided to retain the control upon the manufacture and supply of toilet preparations until June 1948, when the position will again be reviewed. The rate of licensing from January 1, 1948 to June 30, 1948 will remain at the current level, 75 percent of standard period production. The export bonus scheme will also continue in its present form.

New licenses for the period commencing January 1948 will not be issued, the Board having decided simply to extend the date of validity of the licenses at present held by manufacturers and to increase the value of those licenses by an amount equivalent to the normal "quota" for the period ending June 30, 1948.

Alberta Salt Co. Ready To Operate at Lindberg

Soon to begin operations in Alberta, Canada, is the new sodium chloride recovery plant of Alberta Salt Co., Ltd., at Lindberg, 150 miles northeast of Edmonton. Rated plant capacity will be 150 tons daily and the cost is estimated at $800,000. Three major buildings are being constructed: a power house, a three-story process building and a packaging building and warehouse. Temporary living quarters have been erected and it is anticipated that a model townsite will be developed this spring. Actual work on the project started last July.

All customary grades of salt will be

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For confidential, unbiased and intelligent recommendations on your centrifugal problems, consult Tolhurst with its well-qualified staff and modern research facilities.

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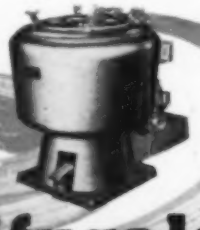

Tolhurst Centrifugals

Division of American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

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produced, and modern packaging and handling equipment is being installed. Formed only recently, Alberta Salt Co. is jointly financed by Anglo-Canadian Oil Co., Ltd., Home Oil and Calgary Edmonton Corp. President of the firm is M. M. Porter of Calgary. G. L. Williams is general manager and plant supervisor is H. Ayres.

Lever Bros. To Make Soap In British Malaya

ANNOUNCEMENT was made recently to the effect that Lever Bros and Unilever were planning to construct a plant at Kuala, British Malaya. The plant will cost $2,000,000 and will be used to produce soap, margarine, and edible oils. It is expected that construction will start as soon as permits for the specialized equipment are obtained in Great Britain. The company owns about 4,000 acres in Malaya on which palm trees are growing and it is probable that Lever will greatly expand the palm oil industry in that section.

Czechoslovakia Chemical Production Increases

NEARLY 67,000 workers are now employed in chemical plants in the Czech provinces of which more than 50,000 are in the nationalized sector. Output in the nationalized industry for the first half of last year was about 65 percent higher than in the comparable period of 1946. In foreign trade, exports of chemicals are gaining and soon may equal the tonnage of imports.

Following a drop in the summer months, production moved up in August and by the end of October, output of phosphate fertilizers reached 89.7 percent of the total planned for that month. Production of sulphuric acid in October was 17,839 tons and for the first ten months of last year, acid production reached 98.1 percent of the planned figure.

Supplies of salt have become more plentiful and this has enabled soda ash producers to expand operations with August and September totals running well in excess of 8,000 tons. For the first ten months production of ash was 94.9 percent of the planned total. Rayon has grown pretty much in line with the rate reported for soda ash and this applies both to yarn and staple fiber.

Chemical interests recently reached an agreement whereby Czechoslovakia will supply finished chemical products to the value of 300 million crowns to Russia in return for Soviet raw materials to the same value. Rus-

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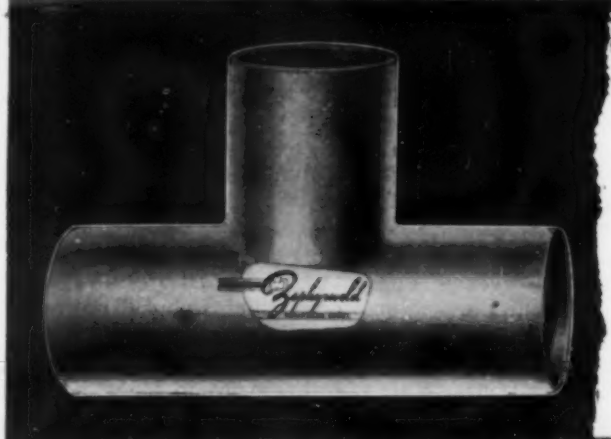

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. . . in sizes from 1" thru 18" O. D., fabricated in gauges from 16 to 10, for use with stainless steel light gauge O.D. tubing, under broad corrosive conditions requiring semi-permanent or permanent welded line installation . . . available in a complete line of ells, tees, crosses, adapters, etc., in stainless steel types 304, 316, 347.

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. . . fabricated from stainless steel type 316 for use with commercial tolerance light gauge tubing having outside diameters from 1" thru 10." Easily assembled with light weight, high strength couplings, which provide an extremely compact, flush, leak-tight union for working pressures up to 250 psi. Complete line of ells, tees, crosses, adapters, etc.

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THE WALLACE PIPE UNION*

. . . . fabricated from stainless steel type 316, permits the use of thin wall stainless steel tubing in connection with standard threaded iron pipe size fittings of all kinds . . . saving from 25% to 45% in material without any loss of effectiveness.

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Fig. F-80

STAINLESS STEEL:
Available in capacities from .57 G.P.H. Fig. F-80 style illustrated, to 104 G.P.M. (Fig. B-8-A style).

"Hollow" cone, "Solid" cone, and "Flat" sprays furnished in pipe sizes and capacities to suit practically any problem where corrosive liquids are sprayed.

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Monarch Fig. 6020 and Fig. 6040 stoneware sprays have replaced most other types of nozzles used in acid chamber plants throughout the world. Last almost indefinitely in sulfur gases and will not break or crack from temperature changes.

HARD RUBBER:
Patented Fig. B-27 nozzle is of the "non-clog" type, i.e. it contains no internal vanes, slots, or deflectors which might facilitate clogging. Available ¼" to 1" pipe. Small sizes produce a very fine, soft, wide angle hollow cone spray, even at low pressures.

Fig. H-407 "flat" spray produces a relatively fine even sheet of liquid.

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sia also asked for a million dollars worth of hollow glass as well as cut and painted glassware. Czechoslovakia also will supply the Soviets with glass for photographic plates, safety glass, as well as 32 million sq. ft. of plate glass. Deliveries probably will be spread over five years.

BRITISH CHEMICAL INDUSTRY AIMS AT 10 PERCENT INCREASE IN PRODUCTION IN PRESENT YEAR

BRITAIN'S chemical industry entered 1948 satisfied with the way in which past difficulties have been overcome and confident that further perplexities will not defy solution. Since the fuel crisis of last winter and the foreign exchange emergency in the summer, British manufacturers are used to manage on very small margins. Plant, labor, fuel, transport and raw materials are usually only just sufficient for operations on the present scale. Any unforeseen contingency would cause an upheaval. Fortunately, this winter promises to pass without major incidents, and next spring some new plant will become available and the export-import adjustment should by then be felt. Industrial management, it is hoped, will be easier in 1948.

Provisional estimates put British chemical production in 1947 slightly above the 1946 figure, but major gains were prevented by coal shortages in the first few months of the year and container, transport and raw material difficulties later on. The export trade was disappointing because of the overriding needs of essential home industries. In the last quarter of 1947 the volume of shipments abroad was one-tenth lower than in the corresponding period of 1946, which had seen an all time record. Expansion schemes were held up by shortages, chiefly of steel, and more particularly stainless steel, and equipment. Leading firms experienced difficulty in staffing their design and construction departments with first-rate men, and shortage of specialized factory labor was reported from various districts.

Costs of production continued to rise; higher coal and rail charges were felt throughout the chemical industry, but the biggest increases in producing costs occurred where imported raw materials are used. The greatly increased cost of vegetable oils and base metals in the world market was reflected by substantial price advances,

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100% WELD
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especially in the paint trade. Industrial alcohol, acetic acid and acetone, solvents, barium carbonate and chloride, glauber salts, and chromates generally also rose sharply, but otherwise prices advanced by not more than 10 percent, and many controlled prices were kept unchanged throughout the year. Cream of tartar has the distinction of being the only material of major interest which was offered at reduced prices towards the end of the year.

The authorities and industrial interests cooperated with the aim of price stability, for both are agreed that easy profits now would seriously handicap the chemical industry in its export drive. So far, however, prices have not been a hindrance to sales expansion; if orders are a little less easy to obtain now in some directions it is because customers are insisting on early delivery. Warnings against the impending end of the "seller's market" have been voiced repeatedly, but there is no evidence of a marked change yet.

With plant being used to maximum capacity, trained labor in short supply, and efficiency and economy in plant operation as urgent as ever, special attention is being paid to automatic plant control. Mechanization of manufacturing processes and introduction of continuous operations wherever possible is desirable also because further additions to the labor force will be obtainable in the main only by recruitment of women. Female labor was found satisfactory during the war but demands suitable adaptation of processes.

Greater Productivity

Higher productivity is needed for a variety of reasons. The chemical industry must certainly not remain below the average increase in production by 10 percent which the Prime Minister has set as the target for 1948. As most plants are fully occupied, any further output gains will have to be achieved primarily by improved performance. To this end further stream-lining of manufacturing operations and improvement of organization and design will be needed. Certain adjustments in producing processes will also have to be made to fit in with the foreign currency economy drive. A few firms have already adapted their plant to the use of alternative raw materials, and others will have to follow suit.

Official control over sales and prices was relaxed only slightly in 1947, and little change is anticipated in this respect for the early part of 1948. Organic chemicals makers in particular

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ACETONE	CH_3-CO-CH_3	58.1	56.1	BELOW —4		186.2	6.59
METHYL ETHYL KETONE	CH_3-CO-C_2H_5	72.1	79.6	34	28	71.2	6.71
METHYL ISOBUTYL KETONE	CH_3-CO-CH_2-$CH(CH_3)_2$	100.2	115.9	81	60	15.2	6.67
MESITYL OXIDE	CH_3-CO-CH=$C(CH_3)_2$	98.1	129.5	98	79	8.0	7.11

AS SOLVENTS, these four Shell Chemical ketones can be used to excellent advantage . . . in surface coatings based on nitrocellulose and vinyl resins . . . in phenolic can coating operations, cloth and paper coatings, airplane dopes, artificial leathers, acetate rayon, photographic film, cleaning compounds, paint removers, adhesives and rubber cement.

In the compounding of lacquers and thinners, their solvency permits solutions of high solids concentration while keeping viscosity characteristics within workable limits.

AS EXTRACTANTS they find widespread use in the preparation of antibiotics, the dewaxing of lubricating oils and in numerous other recovery processes.

AS CHEMICAL RAW MATERIALS these ketones, because of their reactive carbonyl group, permit chlorination, hydrogenation, oxidation and condensation with aldehydes and aromatic compounds.

For full descriptive matter and samples of any or all of the above ketones, write your nearest Shell Chemical office.

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For High Capacity

Trentweld Large Diameter STAINLESS STEEL TUBE keeps your costs in line by the foot by the year by the dollar

IF you have an interest in holding what cost you can to near or below pre-war levels, then Trentweld engineers have facts and figures you will find worth checking against your particular problem. For example, the pictures above show only a few of the hundreds of tubes rolled for the new Champion Paper Mill at Houston, Texas. This tube is type 304 stainless, with a wall thickness of 0.078. **Diameter, is 10 in. and 12 in. I. D.** tube lengths 8 ft. and 12 ft. These specifications assure Champion of process lines with a future free from troublesome maintenance expense.

Trentweld tube ranges in size from ⅛" to 30", is available in wall thicknesses from about 0.002 to about 3/16". It may be rolled from many types of stainless steel or Inconel—whatever best meets the needs of the application. Without obligation address Dept. or send for the Trentweld data bulletin.

TRENTWELD STAINLESS STEEL TUBES

General Office and Mill at
East Troy, Wisconsin

TRENT TUBE MFG. CO.

District Offices
New York, Chicago,

are well satisfied with the present system of control which insures fair supplies of raw materials to all, and the control authorities concerned with this work have also been found of great help when fuel and other questions have to be discussed with different government departments.

Price control has been combined in some directions with official subsidies. In 1947/48 the government intends to spend nearly £7,000,000 on fertilizer subsidies, chiefly on phosphates, to reduce the cost of this essential material to farmers. The element of subsidization does not enter cost calculations for industrial chemicals, but without official direction and supervision prices would no doubt have risen higher. In fact the prices of such important chemicals as boric, citric, hydrochloric, sulphuric, hydrofluoric and nitric acid have not changed at all. Most ammonium, magnesium, potassium and sodium compounds remained at their 1946 levels. So did most coal-tar products, though naphthalene and coal-tar pitch were advanced in price.

Construction Control

Control over new construction work will be intensified in 1948. At first little will be felt of the cuts imposed on capital expenditure as plant nearing completion has been exempted from fresh restrictions. But the general deferment of new building projects in the interest of steel and labor economy will be felt all the more severely in the latter part of this year. It is indeed doubtful whether those new enterprises which are to receive government support will be carried out according to schedule.

A field in which no economies or shortages will be allowed to interfere with the swiftest possible progress is that of research. Here too shortage of skilled personnel has been felt increasingly, while the transfer of new discoveries from the laboratory to the pilot plant and further to the commercial stage has been delayed by equipment shortages. Much no doubt could be done to improve the position by cooperative effort, but most firms still fight shy of an exchange of private research findings even though they support cooperative research associations.

Cooperation with chemical plant makers in order to cut out avoidable delays and difficulties has yielded some satisfactory results in the past year and will be intensified, the more so as chemical manufacturers fear that excessive attention to the exportation of chemical plant would interfere with their own modernization and exten-

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P-15

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Good Automatic Control of Gas and Liquid Flows

1 . . . Safety Shut-off
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3 . . . 2, 3 or 4-Way Directional
4 . . . Pilot Controlled Valves

available either standard or explosion-proof design

There's a lot you can do in the way of automatically controlling the flow of gas or oil with the proper type of solenoid valve. For many applications, the solenoid valve is the best control you can use. It's sure, effective, durable and, of course, automatic.

With an experience in the design and manufacture of solenoid valves dating back to 1910, we have much to offer you in the way of effective automatic control. We'll be glad to study your control problem and make recommendations as to the best valve to use. If necessary, we'll design a special valve as we have done in many cases. Give us complete details when you write.

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When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

Automatic Switch Co.

381 Lakeside Avenue Orange, New Jersey

sion plans. Plant and equipment makers have in some cases been allowed to send representatives to their customers' works to study on the spot how their equipment stands the test of practice. Such practical collaboration will be continued.

The past year has been remarkable for the interest shown in the chemical industry by prominent firms in allied industries. Alcohol distillers, rayon manufacturers, oil refiners, and even steel companeis have taken an active interest in the manufacture of chemical products. Some of them did so in order to develop an outlet for by-products, others entered this field to strengthen their raw material basis. The new year is likely to witness further headway in this process of integration between chemical and allied industries and especially in the chemical utilization of oil refinery derivatives.

Altogether, a further substantial increase in production, especially in the younger branches of the industry, may be expected, but the economic difficulties of the country will still force chemical manufacturers to pay special attention to products for the export market and materials which can help to replace imports. Foreign exchange requirements, however, will not be allowed to divert the industry from the work for which it is best fitted.

Strikes Reduce Chemical Outputs in France

FRENCH chemical companies suffered, together with a large part of French industry, from the Communistic wave of strikes which swept the country from the middle of November until December 10. The chemical workers' union, like most of those in the General Confederation of Labor, is led by Communists. The strikes were launched less than a week after the Confederation leadership on November 13, with the support of the Chemical Workers' leadership, had decided to negotiate with the government until December 19, meanwhile democratically consulting the workers as to whether they would strike if their demands were not met.

The strike continued for about two weeks, with increasing ineffectiveness. By December 9, for example, Kuhlmann, Carbone-Lorraine and Rhone-Poulenc were working again. In the evening of December 9, the top leadership of the General Confederation of Labor called off all the strikes, admitting, in effect, a disastrous failure.

Aside from the direct losses of output during the strike, which have not yet been computed for the chemical industries, the problem of raw mate-

Selective HYDROGENATION

Hydrogenated glyceride oils may exhibit a wide range of characteristics in plasticity and keeping-quality because of the many ways hydrogen combines with unsaturated portions of fatty acid radicals present.

By controlling the variables which affect hydrogenation of glyceride oils, Foster Wheeler's improved process yields selectively hydrogenated oils of high uniformity. Fatty acid content is not increased, which eliminates re-refining; and during operation there is very little hydrogen gas bleeding loss.

Foster Wheeler designs, constructs and installs complete plants for the unit hydrogenation process. One organization with one responsibility gives the manufacturer a completely integrated plant—nothing forgotten, no division of responsibility in matching up components. For complete information, address

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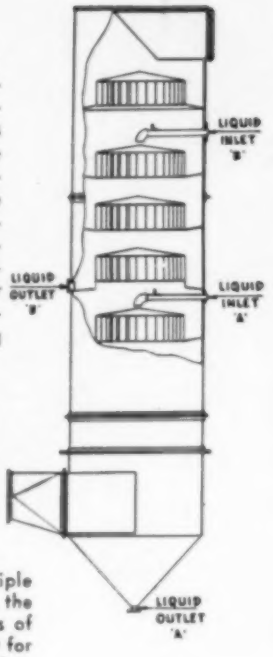
Hydrogen sulphide gas, organic sulfonate dust, beryllium ore dust, mercury vapor bone dust, acid fumes . . . these are just a few of the chemical industry contaminants being removed or reclaimed from the air by Schneible Multi-Wash systems. Center of activity in every installation is the Multi-Wash Collector where the contaminated air comes into intimate, turbulent contact with the proper cleansing liquid.



MULTIPLE LIQUID INLETS FOR *Schneible* COLLECTORS

With no moving parts, the basic Schneible Multi-Wash Collector is readily adaptable to every condition. Where two or more scrubbing or absorbing liquids are required, for example, multiple liquid inlets are provided as shown. The air, whirling up through the impingement stages, passes through two, or more, separate series of liquid curtains and spray. Materials are enveloped and washed out for disposal or reclaiming . . . scrubbing liquid may be recirculated in most cases. Send for Bulletin 410.

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HOMO-MIXERS are available in a wide range of sizes appropriate for laboratories and production plants. Write for complete details. Ask for a copy of Catalog No. 402.

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Processing Equipment for Over 30 Years

rials and power will be aggravated for some time. At least two week's output of coal and a week's output of nitrogen have been lost irrevocably, while ships have had to be diverted from struck French ports. Furthermore, coming wage increases—even though not as high as demanded by the strikers—will have a major effect on prices for French chemicals in foreign markets.

French chemical exports recovered somewhat in October, the latest month for which figures are available. They still remain, however, below the level reached last spring, which will be difficult to regain until some economic stabilization is attained.

Taking the first ten months of the year as a whole, however, the French industry's trade balance shows considerable progress over the same period in 1946. Exports increased 87 percent in value and 41 percent in weight, while imports increased by 20 percent in value and declined 21 percent in weight.

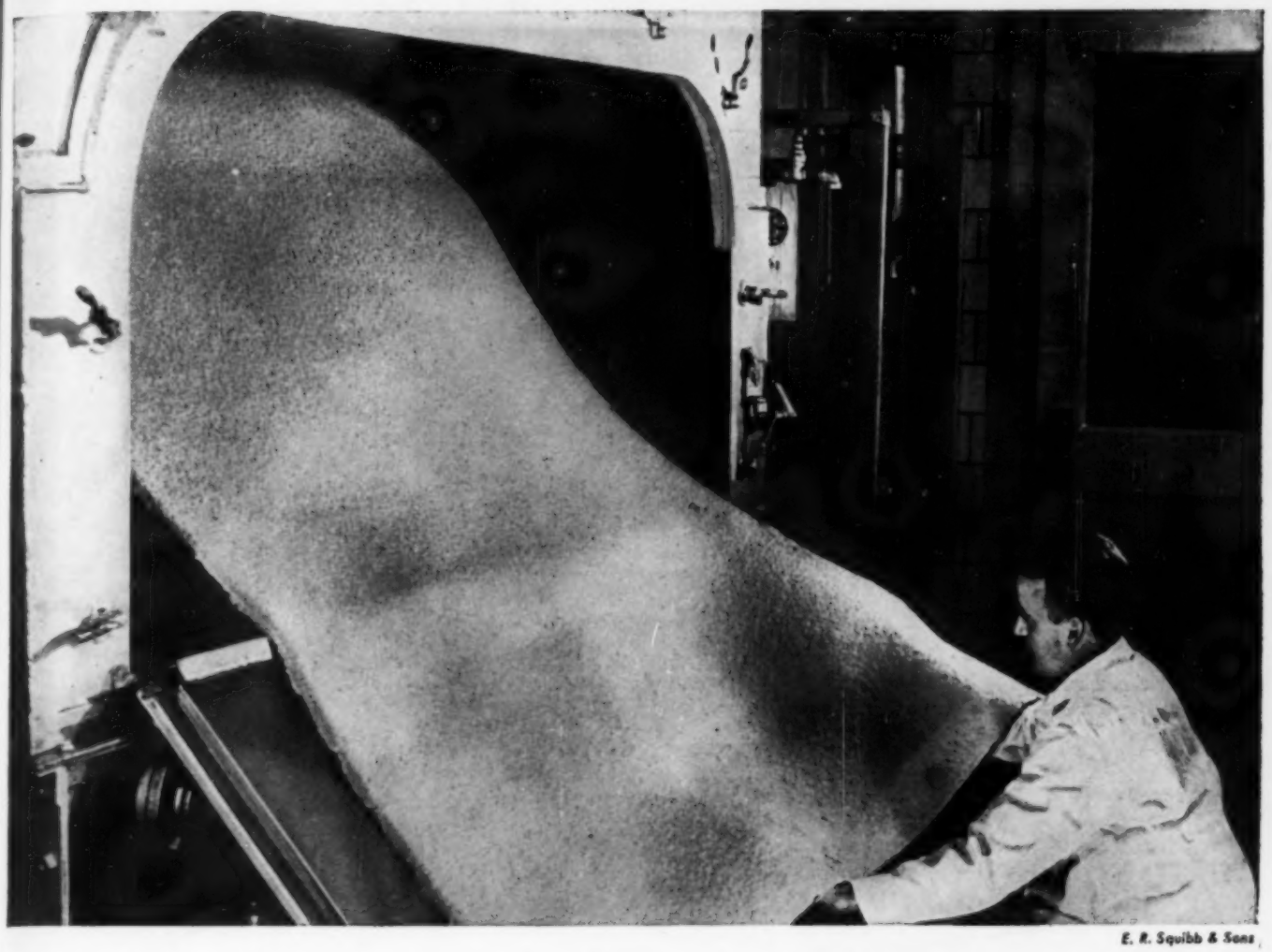
Furthermore French chemicals have tremendously expanded their market this year on the European continent. This has been especially true for highly processed products. Fertilizers and fertilizer elements—a major factor in the French export trade—have generally been shipped in smaller quantities to other European countries this year.

Chemical Shipments

Here are some examples of French chemical shipments in the first ten months of 1947 in millions of dollars, compared with the same period of 1946 shown in parenthesis: to Norway 5.3 (1.8); to Sweden 3.3 (1.7); to Holland 5.3 (2.9); to Switzerland 8.8 (4.6); to Italy 1.7 (.2); to Great Britain 5.2 (1.9); to Finland 1.5 (.7); to Germany 1.6 (.2); to Australia 1.2 (.3). An exception is the important trade with Belgium, which declined from $20 million to $18 million, because of lower shipments of potassium chloride, and the minor trade with Denmark, which declined slightly for the same reason.

The French may be able to continue pushing their expansion in these European markets, thanks to their widespread network of bilateral trade agreements, and the continuing shortage of chemicals on the Continent.

In their trade with the United States, the French continued to furnish us an excellent market, while offering practically no competition in U. S. markets. France received $16 million worth of chemicals from the U. S. through October, compared with $12 million during the same period of 1946.



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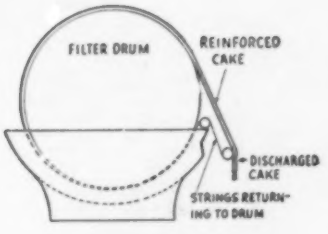
EVER SEE A *better* FILTER CAKE?

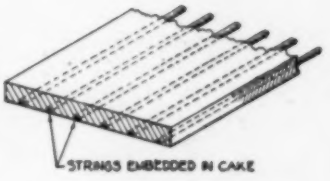
IT'S PRODUCED ON THE FEinc STRING DISCHARGE FILTER

Whether you want a perfect filter cake, or thorough recovery of solubles, the FEinc rotary filter with the exclusive String Discharge, can do it better. The clean, uniform cake of penicillin mold shown above is just one-example.

This is a tough-to-handle fibrous cake—but look how easy it is for the FEinc! Valuable filtrate is saved, too, because it's not necessary to "blow back" through the drain lines to loosen the cake. The FEinc is the only continuous filter that can produce a cake as remarkable as this!

Other features that can be added—if you need them—are the FEinc Washing Mechanism and the 2-6% better Compression Dewatering Mechanism. Send us 5 gals. of your slurry for tests—we'll be glad to show how the FEinc can save for you.





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Pack your towers...with CARBON Raschig Rings!

Advantages of Carbon Raschig Rings

- Corrosion resistant
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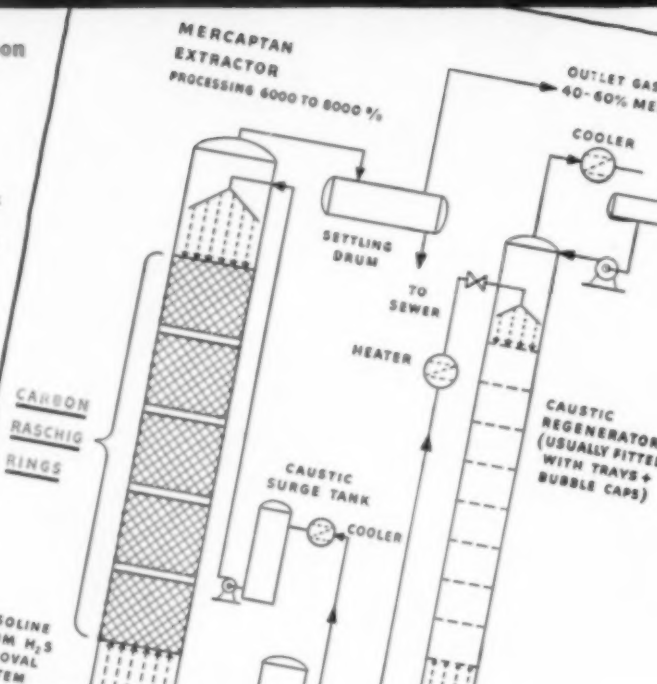
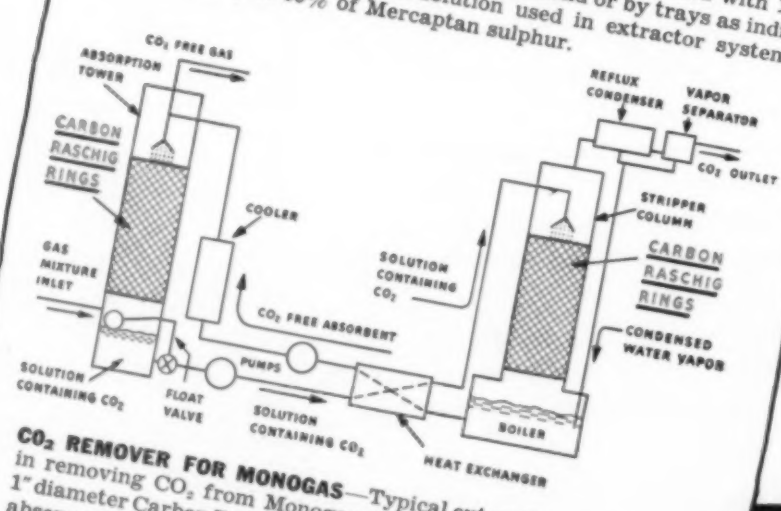


MERCAPTAN EXTRACTOR—Typical Mercaptan extraction system used in oil refineries. Extractor is usually packed with 1" diameter Carbon Raschig Rings, either solid or by trays as indicated. 10% to 20% NaOH solution used in extractor system removing up to 60% of Mercaptan sulphur.



CO_2 REMOVER FOR MONOGAS—Typical extraction system used in removing CO_2 from Monogas. Both towers are packed with 1" diameter Carbon Raschig Rings for maximum contact surface, absence of "channeling," and minimum back pressure. Carbon Raschig Rings are suitable to a wide range of tower-packing jobs.

● "National" "Kempruf" Carbon Raschig Rings provide the most economical and efficient tower-packing material for reaction and scrubbing towers handling corrosive agents, such as hydrofluoric acid, organic-hydrochloric mixtures, and hot aqueous alkalies. These rings are also excellent in extraction systems . . . towers in which sudden temperature changes result in severe thermal shocks . . . rectifying towers . . . and tower processes where thorough dispersion is essential to satisfactory operation.

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THE CORROSION FORUM

Edmond C. Feller, ASSISTANT EDITOR

Nitric Acid Versus Construction Materials

Part I of a symposium in which typical materials of construction are evaluated for services involving nitric acid. Part II will appear next month.

IRON and STEEL

A. W. SPITZ
American Cyanamid Co.
New York, N. Y.

NITRIC ACID solutions up to 75 percent by vol. corrode iron or steel quite rapidly, hence their use in this service is not recommended. Concentrated nitric acid, i.e. 95 percent by vol., is much less corrosive, and iron or steel is occasionally used.

If the water content is under 3 percent and a minimum of 5 percent sulphuric acid is added, the corrosion rate is considerably decreased. As the percent of sulphuric increases, the amount of water may also be increased to a maximum of approximately 25 percent.

Steel tanks, pipe, and cast iron pumps, valves, and fittings are frequently used to store and handle these relatively dry mixed acids at atmospheric temperatures and low velocities, where the presence of iron salts in the acids is not objectionable. Some difficulties with cast iron cracking have been experienced where extremely dry mixed acids were used. For handling mixed acids at high velocities or temperatures, or in dilute solution, use of iron and steel is not recommended.

RUBBER LINING

O. S. TRUE
United States Rubber Co.
New York, N. Y.

CONCENTRATIONS up to 5 percent can be handled at room temperature by semi-hard and flexible ebonite stocks. Concentrations up to 10 percent at room temperature can be handled by specially compounded ebonite compounds.

A concentration of 35 percent at temperatures up to 140 deg. F. can be handled with soft butyl compounds. Further testing of butyl in nitric acid is now underway, and it is hoped that we will be able to take care of even more severe conditions.

Concentrated nitric acid at room temperature can be satisfactorily handled with a vinylite lining.

HASTELLOY

C. G. CHISHOLM
Haynes Stellite Company
Kokomo, Ind.

HASTELLOY C is resistant to dilute nitric acid at temperatures up to 150 deg. F. For nitric acid solutions of over 40 percent concentration, this alloy is recommended for use only at room temperatures. Alloy C is the only one of the Hastelloy alloys that possesses good oxidation resistance. But it is not generally used for straight nitric acid service because stainless steel is satisfactory for such service and is less expensive. Alloy C has been used successfully, however, with nitric acid in combination with reducing conditions that tend to remove the passivating film from the stainless steels.

In cold solutions of nitric acid containing varying amounts of hydrochloric acid, and also in combinations of nitric and hydrofluoric acid, Hastelloy C has shown good resistance.

The other Hastelloy nickel-base alloys—A, B, and D—do not contain chromium and thus are not resistant to strong oxidizing conditions. As these three alloys will be readily attacked even in cold dilute nitric acid, they should never be used in this type of service. Caution should be employed to avoid additions of nitric acid to solutions of such corrosive agents as sulphuric acid and hydrochloric acid, to which these alloys do possess excellent corrosion resistance.

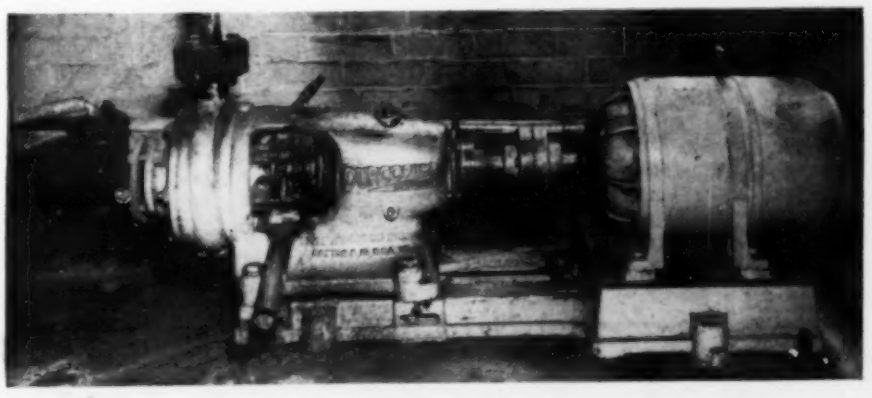
The cobalt-base Haynes Stellite alloys, particularly Haynes Stellite alloy No. 1, possess excellent resistance to nitric acid. Therefore, they can be satisfactorily used for facings on valve seats and parts subjected to nitric acid corrosion, as well as to severe abrasion.

DURIMET, CHLORIMET

WALTER A. LUCE
The Duriron Co., Inc.
Dayton, Ohio.

DURIMET 20 gives excellent resistance to nitric acid at all concentrations and temperatures. The highly oxidizing character of this acid is ideal for Durimet 20 which normally depends on the formation of a "passive" film for its corrosion resistance.

Durimet 20 is an austenitic stainless alloy with a nominal composition as



Durimet pump after four years service handling 30 deg. Be. nitric acid at room temperature. Duriron valve shown has been on similar service since 1932.

4 UBS Peroxides specifically created for curing low pressure laminates and castings

Creative chemistry from the laboratories of UBS scores again with these 4 efficient catalysts for commercial polyester resins. All produce rapid conversion at low temperature . . . improve physical properties . . . facilitate handling . . . increase clarity in cast productions. All are completely soluble in aromatic solvents, insoluble in water.

1—HYDROXYCYCLOHEXYL HYDROPEROXIDE—1

Thermal Decomposition: 71°C . . . soluble in organic solvents, insoluble in water . . . white crystalline solid.

60% TERTIARY BUTYL HYDROPEROXIDE

Thermal Decomposition: 89°C . . . soluble in short chain aliphatics and aromatics . . . water white liquid.

TERTIARY BUTYL PERBENZOATE

Thermal Decomposition: 116°C . . . soluble in organic solvents, insoluble in water . . . straw-colored liquid.

DI-TERTIARY BUTYL DIPERPHTHALATE

Thermal Decomposition: 108°C . . . soluble in organic solvents, insoluble in water . . . white crystalline solid.

Use these 4 UBS peroxides with Laminac #4125, Selectron #5003, Vibrin #103, Allymer CR-39, Marco MR, Plaskon #911, Paraplex, Bakelite BRS and XRS series, Thiokol Liquid Polymers, di-allyl Phthalate, Thalid Resin . . . and many others.

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follows: 29 percent Ni, 20 Cr, 2.0 Mo, 3.5 Cu, 1.0 Si, and 0.07 C max. It is available in either the cast or the wrought form.* Durimet 20 is supplied in many types of engineered equipment such as pumps, valves, fans, ejectors, jets, and mixing nozzles.

High silicon iron is generally preferred over Durimet 20 in nitric acid service when cost is paramount. However, many applications require the use of machinable alloys, and it is generally for these conditions that Durimet 20 is used. The conventional 18-8 stainless steel also gives adequate resistance to nitric acid in many cases, but the presence of other constituents or impurities generally means that better performance will be attained through the use of Durimet 20. The relative resistance of Durimet 20 and 18-8 stainless steel to mixed acid (sulphuric plus nitric) is a good example.

Numerous service applications can be cited involving Durimet 20 in nitric acid or solutions containing nitric acid in substantial amounts. A few will be given as follows to typify the service of this alloy:

1. A chemical plant found Durimet to be much more satisfactory than 18-8 stainless steel for handling hot, 97 percent nitric acid from concentrating towers.

2. Durimet pumps are used in another chemical plant for handling 20-30 percent nitric acid in the manufacture of arsenic acid. Excellent results were reported.

3. Numerous Durimet pumps are used in another plant for handling nitric acid and ammonium nitrate solutions. Excellent results were reported after five years continuous service.

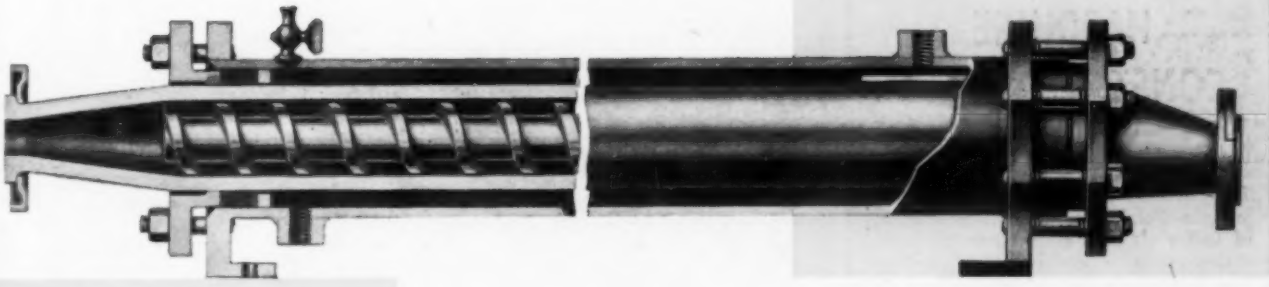
4. Durimet is giving excellent results as equipment for handling hot, dilute nitric acid plus silver nitrate solutions.

5. Durimet steam jets are used in a steel mill in the electrolytic pickling of stainless steel strip. The corrosive solution used is 20 percent nitric acid plus 3-5 percent hydrofluoric acid. This solution proved corrosive to all

* WROUGHT DURIMET-20 in the form of rod, bar, wire strip and welded tubing is now available "off the shelf." Carpenter Steel Co. in Reading, Pa., made significant news last month when they announced that they were rolling those shapes on full commercial scale. With over 50 percent alloy content Durimet-20 is not the easiest alloy to roll. Until now no mill has appeared willing (or able) to wrestle with it. Carpenter has put it over—and, they insist, without fudging a bit on the regular casting analysis of the Duriron Co.'s alloy. Carpenter will market their own products under the name Carpenter Stainless-20. Cost will be some 3-4 times that of Type 316. The company doesn't plan to produce the final end products for which their shapes are intended but promises assistance in contacting fabricators of such items as valve stems and trim, pump shafts and shrouds, tie rods, bolts, nuts, filter wire, screen, heat exchangers, pipe and fittings.—*Editor.*

6 advantages of this NEW DURCO CORROSION-RESISTING HEAT EXCHANGER for the Chemical Industry

1. **MADE OF DURIRON, the high silicon iron that closely matches the broad corrosion resistance of non metallic materials. It retains excellent resistance to the common corrosives at all concentrations and temperatures.**
2. **NO DILUTION of solution.**
3. **EXCEPTIONALLY HIGH K VALUES obtained by a unique design that fully utilizes the pressure drop to break down the fluid film.**
4. **COMPLETE FLEXIBILITY OF INSTALLATION. Can be installed horizontally or vertically, near the ceiling, on the next floor, or in the next room. Supplied in banks supported on a single frame, if desired.**
5. **NO PACKING AGAINST THE CORROSIVE SOLUTION.**
6. **REPAIRS (if any) made without emptying solution tanks or shutting down.**



Standard Durco units are available with one to nine or more heat exchangers in banks — together with the necessary corrosion-resistant valves, pipe, fittings and pump — supported by one frame. Prints showing typical layouts will be sent on request. Ask for Folder T.

Now available for the first time — a heat exchanger that is applicable to the many heat exchange problems in chemical process plants. The *new** Durco No. 4 and No. 8 heat exchangers provide a *high* temperature rise or drop in *one* pass. The small size of the units permits flexibility of arrangement. They can be set up in series or parallel — or both — to handle from 5 GPM to 100 GPM with temperature changes of 300° F. Examples:

1. Cooling 20 GPM of 70% H_2SO_4 from 360° F. to 150° F., with 80° F. water, requires 24 8C coolers, four parallel banks of six units each in series.
2. Cooling 14 GPM H_2SO_4-hydrocarbon mixture from 235° F. to 95° F., using 20° C. water, requires 10 4C coolers in two parallel banks of five units each in series.
3. One Duriron 4C cooler will cool 15 GPM bleach solution from 80° F. to 65° F. with cooling water at 45° F.

Write for Bulletin 1603.

*Not to be confused with the thousands of Duriron No. 6 and No. 12 heat exchangers in service, the primary application of which was to maintain a fixed temperature of a volume of solution where the rate of recirculation and temperature rise was of secondary importance.

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CORROSION RESISTING
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DURCO Adv. 51-GM

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CONSTANT-WEIGHT
FEEDERS

The revolutionary Hardinge Constant-Weight Feeder regulates the feeding of materials at a constant-weight rate, rather than a constant-volume rate. The feeder automatically compensates for changes in *specific gravity* and *bulking*, due to moisture—which normally would cause irregular feeding.

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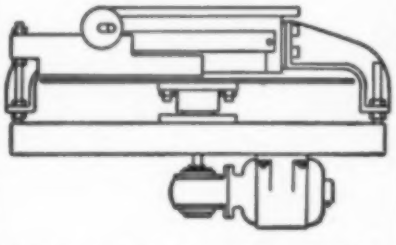
FEEDERS, TOO



Ideal for handling hot, sticky or bulky materials—the Hardinge Disc Feeder is simple, requires little head room, and has two capacity adjustments, one of which can be changed during operation. No bridging—no clogging.

Write for Bulletin 33-D which describes the complete line of Hardinge feeders in detail.

HARDINGE
COMPANY INCORPORATED
YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works
NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
SAN FRANCISCO 11—24 California St. • 200 Bay St.—TORONTO 1

the metallic and non-metallic materials tested with Durimet 20 giving the best service.

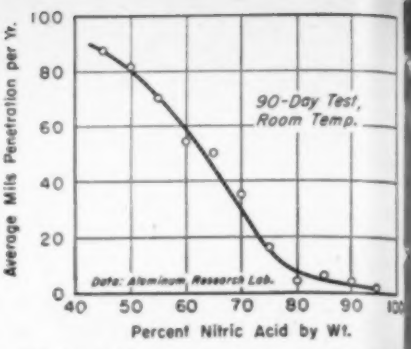
Chlorimet 3 is a nickel base, high alloy material with a nominal chemical composition of 60 percent Ni, 18 Cr, 18 Mo, 2 Fe, and 0.07 C max. The high chromium content makes it applicable for most nitric acid services, but its use is generally limited because of its higher price. Conditions involving severe services with nitric acid as a minor constituent may be handled with this alloy.

Chlorimet 2 is also a nickel base, high alloy with a nominal chemical composition of 63 percent Ni, 32 Mo, 3 Fe max. and 0.15 C max. This alloy is not recommended for nitric acid services.

ALUMINUM

J. P. BALASH and ELLIS D. VERINK, Jr.
Aluminum Co. of America
New Kensington, Pa.

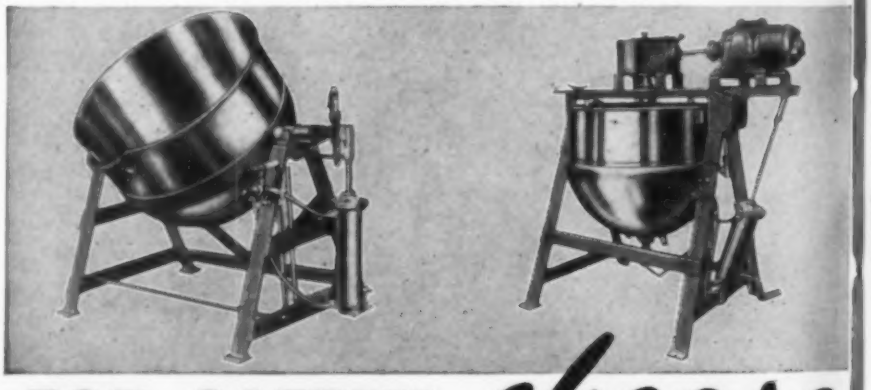
Most of the large producers of nitric acid, made by the ammonia oxidation process, have for many years recognized aluminum and used it extensively. Aluminum chemical equipment has given long and uninterrupted service, not only in the production of nitric acid, but also in the production of sundry products in whose manufacture nitric acid is employed.



Nitric Acid versus Aluminum (25-H)

Concentrated nitric acid (80 percent or above) and its vapors have only slight effect on aluminum at room temperature (see curve). Since solutions of the lesser oxides of nitrogen and the gases themselves attack aluminum only superficially, aluminum is used commercially in reaction vessels for the catalytic oxidation of NH_3 and cooling coils, or condensers, for the concentration of the acid, as well as pressure piping. To handle concentrated nitric acid (80 percent or greater) made by the ammonia oxidation process, aluminum alloy storage tanks, ICC approved tank cars, syphons, and containers are employed.

Nitrous gases can as a rule be han-



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Corrosion-Resistant
KETTLES
WITH HYDRAULIC OPERATING CYLINDERS •
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LEE METAL PRODUCTS CO. INC.
417 PINE STREET . . . PHILIPSBURG, PA.
ALL LEE KETTLES ARE MADE TO A.S.M.E. CODE

Get the pump with all these features:

1. Pump and motor in ONE rigid frame, on ONE shaft, to eliminate alignment troubles.

2. Drip-proof motor specially designed by Allis-Chalmers for efficient pumping service.

3. Bronze wearing rings easily and economically replaceable for long pump life.

4. Generous packing — five or more rings, reduce leakage and frequent servicing.

5. Plastic water seal gives positive control, and requires a minimum of attention.

THE *Electrifugal* PUMP

PEDRIFUGAL
The new A-C pump for flexible Texrope V-belt drive. Capacities to 500 gpm, heads to 100 ft.

SS UNIT
Close-coupled pump and motor units, made in 234 standard ratings, to 2500 gpm.

QUICK INSTALLATION — It's a complete, low-cost pumping "package" — ready to hook up and put into service for a wide range of applications. Can be mounted in any position — fits into close quarters. Made to handle most liquids, with capacities from 15 to 1400 gpm, heads to 500 ft.

HIGH EFFICIENCY — Pump and motor are engineered and built together as a smooth-working team, and Allis-Chalmers takes undivided responsibility for performance. Every Electrifugal pump is run and tested at the factory for efficiency, capacity and head.

IMMEDIATE DELIVERY — Many sizes of Electrifugal, PEDRIFUGAL and SS UNIT pumps are now in stock at convenient points. Phone or wire your nearest Allis-Chalmers office or dealer for latest information on stocks and deliveries. For description of the complete line of A-C centrifugal pumps, to 600,000 gpm, ask for Bulletin B6059D. ALLIS-CHALMERS, MILWAUKEE 1, WIS.
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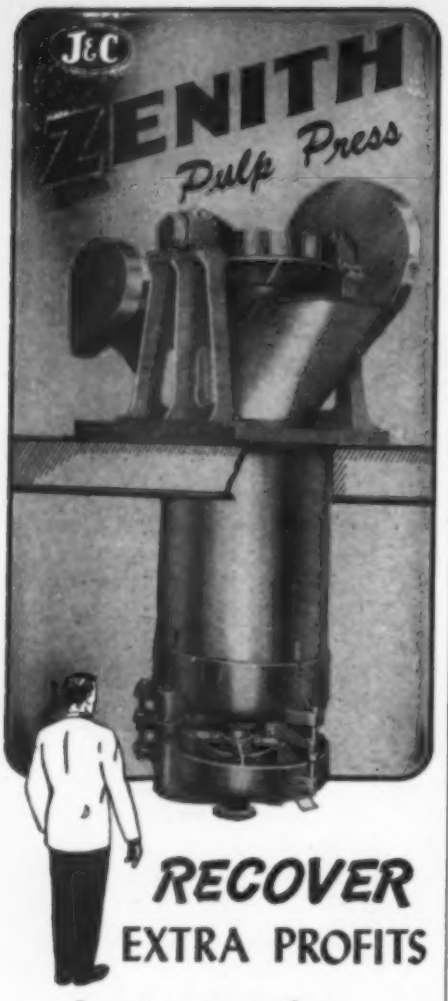
One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products



RECOVER
EXTRA PROFITS

... by Increasing
PRESSING EFFICIENCY

New uses for the Zenith Pulp Press are being discovered every day. Among the many installations for DEWATERING are: BEET PULP • PINEAPPLE • TOMATO POMACE • CORN GERM and FIBRE • VEGETABLES • BREWER'S GRAIN CHERRIES • CITRUS FRUITS • FISH • PAPER PULP RECLAIMED RUBBER • TANKAGE • etc.

100% continuous ... from storage bin to pressed cake, the Zenith Pulp Press dewaters up to 26 tons of wet pulp per hour.

The material is fed mechanically to a tapered screw-type spindle that compresses and forces it through the press, discharging liquid through the central orifice and pressed cake to conveyor for disposal.

Constantly rolling pulp assures maximum dewatering. Heater resistors permit steam injection.

A Pilot Press is available for trial in your plant.

"Work Well Done Since '81"

A PRODUCT OF
Jackson & Church Co.
SAGINAW, MICHIGAN

dled in aluminum, although the lower oxides, when dissolved in nitric acid may increase the rate of attack slightly. Aluminum hoods, ducts, and covers for nitrating tanks are widely used for the handling of gases which contain oxides of nitrogen.

In the manufacture of nitric acid base explosives, the non-sparking property of aluminum, as well as corrosion resistance, is used to advantage. Aluminum evaporators and crystallizers have been used for the processing of ammonium nitrate, thereby avoiding harmful contamination.

PRECIOUS METALS

E. F. ROSENBLATT
Baker & Co., Inc.
Newark, N. J.

Silver—Silver is rapidly attacked by nitric acid both hot and cold. It is therefore unsuitable as material of construction exposed to nitric acid.

Gold—In contrast to silver, gold is known for its resistance against nitric acid; for instance the old art of differentiating between gold rich alloys and those of low gold content is based on the high resistance of gold to nitric acid. Dilute nitric acid has no effect on gold; boiling nitric acid of a specific gravity of 1.5 dissolves gold only at the rate of approximately 0.185 mils per yr. A substantial weight loss, however, is observed on exposing gold to boiling concentrated acid of a specific gravity of 1.42, the loss averaging 6 mils per yr.

Platinum—There is no doubt that platinum is more resistant to nitric acid even than gold. No matter what the dilution, platinum will resist the attack of nitric acid in the whole temperature range between room temperature and boiling. Even under the extreme temperature conditions of the ammonia oxidation process (around 900 deg. C.) platinum and its alloys show a truly excellent resistivity as catalysts. Platinum rhodium gauze will produce in excess of 50 tons acid per ounce of metal before it requires reworking. The metal costs only a few thousandths of a cent per pound of acid. Platinum alloys like iridium platinum and rhodium platinum are just as corrosion resistant as platinum itself.

Palladium—Palladium is strongly attacked by boiling 10 percent nitric acid and is not completely resistant even at room temperature. At certain concentrations of acid, palladium shows some passivity to the formation of a protective layer but never sufficiently so to allow its use as corrosion resisting material against nitric acid. However, alloys of palladium and platinum may be used provided the palladium is kept to 20 percent or less.

New! TERRISS 3-SPEED
PORTABLE MIXER

STIRS • BLENDS
MIXES • AGITATES

No more carrying heavy mixer . . . clamping to tanks . . . breaking side walls

The New TERRISS 3-Speed Portable Mixer is an all-around unit that will take care of all your mixing, blending and agitating problems. If your tank or vat is below floor level the TERRISS 3-Speed Mixer will reach down and do a real job for you. If your container sits on the floor, a little adjustment and the mixing begins. If your tank or container is high off the floor, the TERRISS Mixer will lift up and do the mixing job. All parts that touch your product are Stainless Steel. Standard belt drive permits propeller speeds of 175 RPM, 325 RPM and 575 RPM. Other combinations are available with simple adjustments. Both propeller shaft and stand are adjustable, permitting unlimited settings to fit any job in your plant.

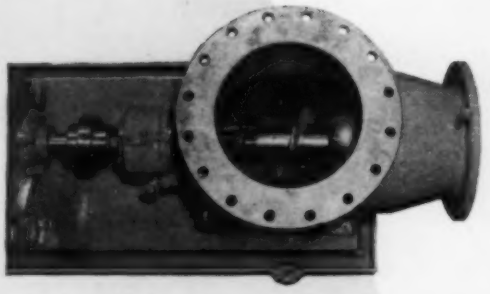
Send your order today . . . money-back guarantee

CONSOLIDATED
SIPHON SUPPLY CO., INC.
Dept. C, 22-24 Wooster St. New York 13, N. Y.

heavy pulp moves *fast!*

Six of the new BJ *Pulp Pumps*—— in series with the new BJ screw feeder pump, handle 8 to 10% Stock with ease

8 TO 10% STOCK IS HEAVY! But not too heavy for the pumping set-up engineered by BJ for a large Mid-Western pulp mill. Six 100 hp, 6″ x 12″ BJ *Special Duty* Pulp Pumps operate in a series. The suction of the first pump is fed by a 16″, 15 hp BJ Screw Feeder Pump. No suction line trouble, no clogging. Flow is smooth and positive. (These *Special Duty* Pulp Pumps are identical in design to the new *standard line* of BJ Pulp Pumps, except for impeller size.)



Top view of BJ Screw Feeder Pump

THE NEW BJ PULP PUMPS can be converted to acid and liquor service (or back to pulp stock service) merely by changing a few pump parts. For hot service, the standard stuffingbox can be replaced with water-jacketed stuffingbox. Entire bracket, rotating element and pump cover can be unbolted and lifted free from case without disturbing suction and discharge piping. Impeller clearance adjustable without dismantling. *Standard Pump Capacities to 4000 gpm. Heads to 200 ft. Sizes to 10″.*

BJ PULP PUMPS
STOCK CONSISTENCY RANGE

	Standard Pumps	Special-duty Pumps
Normal Range	Up to 6%	
Range with Screw Feeder Pump in Series	6% to 8%	8% to 10%

Byron Jackson Co.

Established 1872

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Getting along in bad company

Survival of the fittest certainly applies to industrial instruments. Though precision instruments in every sense, they must withstand a collection of corrosive conditions that would rival the proverbial Hades.

Every Brown Thermometer and Pressure Gauge is protected against the usual tough conditions in Industry. You'll find that they stand up well and give performance even beyond normal expectations.

When the going gets too rough, the Brown Field Engineer has a number of strong-arm tools for use on extra tough applications.

A polyvinyl plastic covered capillary on thermometer systems will ward off a whole array of enemies to metal. Likewise, high or low pressure seals with the proper sealing medium will protect the delicate elements of a pressure gauge against most corrosive attacks.

These "little" considerations in design and application of instruments are why users have come to expect better and longer performance from Brown.

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DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO.

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BROWN *Advanced Instrumentation* FOR BETTER PROCESSING

Product of MINNEAPOLIS **Honeywell**

FROM THE LOG OF EXPERIENCE

Dan Gulleken, ENGINEER

HOUSE 13 at Grand Junction, Colo., could attribute its ills largely to farmer apathy to beet culture—no beets, no sugar and no enthusiasm. The house, built in 1899, was the first in the state of Colorado. The bold promoter and financier, none other than the famous Charles Boettcher of Denver, accepted regular annual deficits as the price of the development of the pioneer beet sugar estate. Because of late completion of the plant, operation did not start until November 1 and extended until March 5.

Boettcher averred that all he had at Grand Junction was empty sacks, alibis, excuses and losses. The chemist's report showed a good yield but it did not appear in the bag. Nevertheless before the processing of the first crop had been completed, Boettcher ordered the farmers to get under way with the planting of the next one. By 1904 the farmers had developed increased interest and a generous acreage was subscribed. Accordingly GHQ set aside a liberal appropriation for maintenance and installed a new crew so as to remove the habit of failure. The vice president, exercising his exclusive prerogative, selected the new superintendent, master mechanic and other key men. "Cal," the master mechanic, had had experience in similar jobs in the construction of two houses, in Idaho and Michigan, where he had the advantage of complete blue prints to guide him. Otherwise he was a mine mechanic of skill in the days when rope drives were popular for power transmissions, short and long. Cal looked about to see what he could change. There wasn't anything wrong with the leather belts but they were not the kind of thing he was used to at the mine. He therefore removed the main engine belt and installed the efficient though hazardous continuous rope system. Then he reconstructed the good old orthodox direct acting, flywheel-balanced steam pump at the river a thousand feet away, installed a grooved flywheel and connected it aerially by rope drive to an engine erected on the second floor in the factory. At least the replacement of the long underground live and exhaust steam lines with ropes promised a thermodynamic advantage.

Superintendent George Bushby also added his mite in the way of improvements. George received his basic training in a Scottish regiment in Egypt and had arrived at the exalted rank of sergeant. He had a nimble mind and had acquired the military art of quick decisions and the demand for prompt and unquestioned obedience. Industrywise he had started at Chino, California, in 1894 as helper to Hugo Rickes who had been sent from Germany to install the new Steffen process and to train operators.

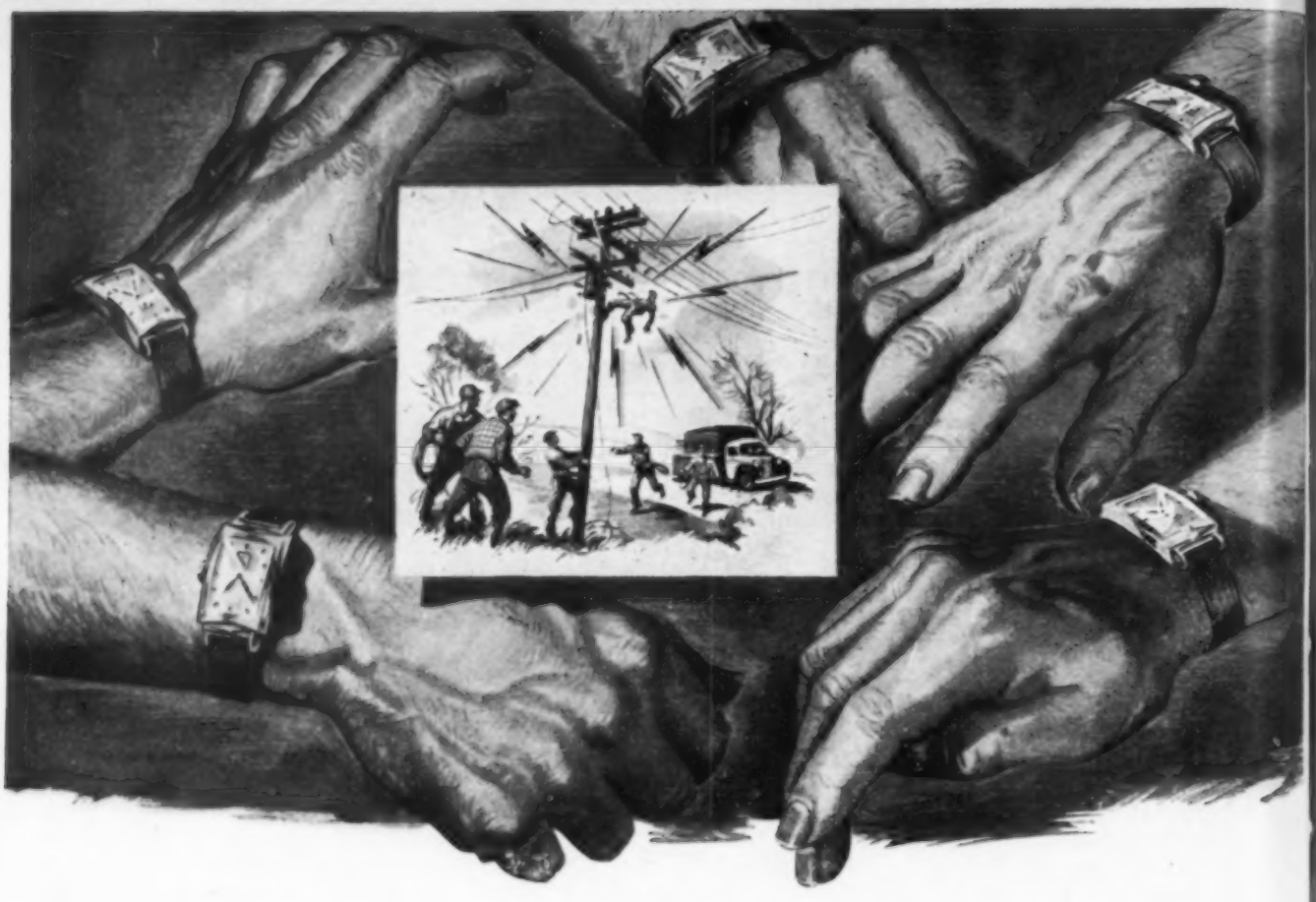
THE SERGEANT and Hugo were not compatible, so George joined Dyer's construction crew, alternating between construction and operation. He possessed excellence as a rigger and, according to custom, tarried with the constructors to boss the rural recruits in the preliminary operation of the works. The construction engineer's responsibility was concluded as soon as the plant achieved rated capacity and maintained it for ten days. As an operator, George had attained the eminence of foremanship at St. Louis, Michigan, in 1903 and from this job Manager McKinnie picked him to go to Grand Junction as superintendent. He was quick witted and efficient and he did not conceal his light under a bushel basket. His staff soon learned who was boss.

IN THE FALL everything was set. Beets were coming in fast. The "improvements," however, were a headache. One day sergeant Bushby wired McKinnie, presently at his Garden City, Kan., factory, "Come quick. Bushby." McKinnie dropped everything and sweated through the 18-hr. journey on the combination to Grand Junction. He rushed to the works and excitedly asked Bushby what was wrong. Bushby told him to go to the office and he would join him soon. Presently he arrived with Cal in tow. Turning to the manager he asked, "Mac, did you hire this man?" Mac answered, "Yes." "Well," said Bushby, "you fire the so-and-so."

RAW BEET JUICE is composed of water, sugar and "impurities," now preferably called non-sugars, since they are processed into useful products. Refining is approached in two ways: either you take out the sugar or you take out the non-sugar. First the fresh heated beet juice is treated with lime. The lime has an affinity for the impurities and the combination is subsequently precipitated by carbonation, leaving a filtrate of sugar and water plus some slight impurity. The filtrate is concentrated and pure crystals fall out while end product molasses (mother liquor), possessing much color and impurity, remains. Lime does not readily attract the impurities in the thick molasses but when the molasses is diluted and chilled to 25 deg. C., the lime, according to the Steffen process, combines with the sugar into calcium trisaccharate, insoluble in cold water. Now the filtrate becomes the waste and the saccharate cake is delivered to the raw hot juice where it gives up its sugar while the lime combines with the impurities in the fresh juice. The liming of raw juice requires about 2½ percent of lime on sugar. The molasses, containing about 3½ percent of the original sugar content of the raw juice requires about one pound of lime per pound of sugar. Thus the lime does duty twice.

YEARS AGO "Pure Food" Wiley tried alcohol as a solvent in connection with the extraction of sugar from sorghum. Our Doc spent a lot of time trying to coax a solvent to attract the impurities in molasses and thus removing the unwanted matter by way of the filtrate. Now comes ion exchange that delivers filtrate of pure sugar solution and sends non-sugars out in the lixiviation water.

The "Brake Shoe Private Wire" noted an example of this dual approach in a suburban garden. The owner was interviewing an applicant for the job of keeping her flower garden free of weeds. She asked him if he knew all the flowers. He admitted that he knew only a few of them but on the other hand he knew all the weeds.



Six Workers + E-M Foresight = Five Heroes

Employers Mutuals Job Safety Training seemed "dull stuff" until the moment of tense drama came . . .

All six men of the power-line crew had received Employers Mutuals safety training... wondered whether such "dull routine stuff" was necessary, until one day—

A severe electric shock hurtled one of their number from a pole, his clothing aflame. His five mates, ready for such emergency, quickly beat out the flames, loosened his clothing, induced artificial respiration, had him well on the way to recovery within a half hour.

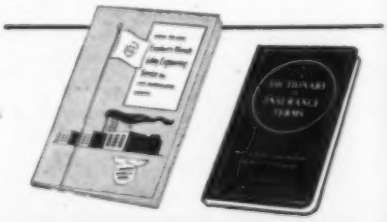
Each received a gold watch from Employers Mutuals in recognition of his part in saving a fellow worker's life.

Throughout industry, in every type of business, thousands of men and women are taught such life-saving practices, trained how to act in an emergency by Employers Mutuals engineers and industrial nurses.

Skill in accident prevention, control of industrial health hazards, development of first aid programs . . . all are accomplished with a tactful, human approach that builds good will and makes Employers Mutuals services unique in the insurance field.

Employers Mutuals write: Workmen's Compensation—Public Liability—Automobile—Group Health and Accident—Burglary—Plate Glass—Fidelity Bonds—and other casualty insurance. Fire—Extended Coverage—Inland Marine—and allied lines. All policies are nonassessable.

Your plant accident experience materially affects the cost of your workmen's compensation insurance. Send for Employers Mutuals' booklet, "Safety Engineering." It explains the importance of such facilities and experience in keeping your accidents under control. Also be sure to have our "Dictionary of Insurance Terms." It will help you to understand the provisions of your policies. Send for these valuable, informative booklets on your letterhead—or call your local Employers Mutuals man.



Employers Mutuals Policies Protect Lives, Health and Property

EMPLOYERS MUTUALS OF WAUSAU

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EMPLOYERS MUTUAL LIABILITY INSURANCE COMPANY OF WISCONSIN
EMPLOYERS MUTUAL FIRE INSURANCE COMPANY
HOME OFFICE: WAUSAU, WISCONSIN
Offices in Principal Cities—Consult Your Telephone Directory

NAMES IN THE NEWS

Man of the Month

G. Slayter

Featuring the winter meeting of the Industrial Research Institute at Rye, N. Y., was the presentation, on February 5, of the Institute's 1948 Medal to **Games Slayter, vice** president in charge of research and development of Owens-Corning Fiberglas Corp. Mr. Slayter was cited for his leadership in the development of glass fibers and their commercial application.

Games Slayter was born Dec. 9, 1896, and received his degree in chemical engineering from Purdue University in 1921. In 1931 he became associated with what is now the Owens-Corning Fiberglas Corp. as consulting engineer. His efforts were first directed toward the production of new products and new uses for glass, and improved machinery for manufacturing glassware. Most important of these developments was in the field of fibrous glass. Fiberglas may be regarded as still in its infancy. Its largest present uses are for electrical and heat insulation and for many types of fabrics.

Mr. Slayter lives on a farm, in Newark, Ohio, has two children, and celebrated his 30th wedding anniversary last August.

Charles Allen Thomas, executive vice president and technical director of Monsanto Chemical Co., St. Louis, Mo., has been selected to receive the 1948 gold medal of the American Institute of Chemists. Presentation of the medal to Dr. Thomas will be made at the annual meeting of the Institute, to be held in New York, N. Y., on May 8, 1948.

R. L. Minckler, formerly executive vice president of General Petroleum Corp., Los Angeles, has been elected president. He succeeds **S. J. Dickey,** president since 1941, who is retiring.

John R. Hoover, vice president of the B. F. Goodrich Chemical Co. and **D. S. Frederick,** vice president of Rohm & Haas Co., were re-elected president and vice president, respectively, by Plastic Materials Manufacturers Association at its annual meeting last month.

E. C. Williams, vice president and director of research for Schenley Distillers Corp., recently was named treasurer and elected to a fellowship in the New York Academy of Sciences.

Robert T. Baldwin of New York has retired as treasurer of the American Chemical Society after 16 years of service. He will continue as chairman of the society's finance committee.

R. T. Baldwin

J. McWhirter

James McWhirter, has been named superintendent of the new fluorine chemicals plant to be built by the Pennsylvania Salt Manufacturing Co. near Paducah, Ky. McWhirter, recently placed in charge of fluorine product process development and manufacture for the company, is former superintendent of Pennsalt's Natrona, Pa., plant.

David M. Clark has joined the research and development laboratories of the United States Stoneware Co., Akron, Ohio, as research chemist. He was with Firestone Laboratories as research chemist in plastic development.

D. M. Clark

R. Williams, Jr.

Roger Williams, Jr., joined the staff of Chemical Engineering January 1 as assistant editor. Employed since 1941 in the ammonia and plastics departments of the Du Pont company, Mr. Williams has contributed frequently to the chemical press. He is a graduate of Amherst and has taken special courses in chemical engineering and business administration at M.I.T.

William F. Orr resigned last month as superintendent of the pilot plant of the Government Laboratories operated by the University of Akron as agent for RFC. He has joined the research and development division of the Western Cartridge Co.

Edmund W. Sinnott, dean of the Sheffield Scientific School and director of the Yale University division of sciences, has assumed office as president of the American Association for the Advancement of Science.

Carlton S. Proctor, New York, and **John W. Cunningham,** Portland, Ore., have been elected vice presidents of the American Society of Civil Engineers for 1948.

George Rieger has joined the research department of Hercules Powder Co.

Thermocouple LEAD WIRES

Quality of thermocouple and extension lead wires depends on careful processing controls. We have these controls. Our skill, high standards of accuracy and complete insulating facilities produce pyrometer wires that will meet your most rigid requirements.

Our Iron Constantan, Chromel Alumel, Copper Constantan wires, stranded and solid, are made in many sizes and types, and are available with plastic, asbestos, cotton or fiberglas insulations.

Certificates of Calibration, giving temperature deviations from standard EMF values, are supplied with all wire for thermocouples; and will be furnished, upon request, with lead wires.

Send for Lead Wire Bulletin 30 or Complete Catalog Describing.....

THERMOCOUPLES - ACCESSORIES
QUICK COUPLING CONNECTORS
LEAD WIRES—PROTECTION TUBES

Thermo ELECTRIC CO.
FAIR LAWN, N.J.

For better results

STANLEY FILTER FABRICS

FILTER FABRICS ALL KINDS
Cotton, Flax, Wool

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Acid-resistant filter cloths

CLOTHS CUT and FABRICATED INTO PRESS SACKS
for all purposes
GRAVITY FILTER BAGS

DUST-ARRESTING TUBES DISCS and VACUUM BAGS CENTRIFUGE LINERS
in all sizes with fittings

Write for samples and prices
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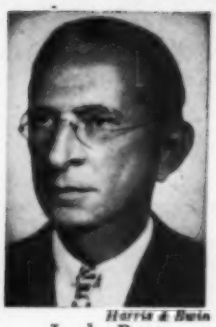
Harris & Ewin
L. du Pont

W. J. Beadle

as technical assistant to the director of research.

Crawford H. Greenewalt became the tenth president of E. I. du Pont de Nemours & Co. on January 19, while **Walter S. Carpenter, Jr.,** was elected chairman of the board. Mr. Carpenter's resignation as president, and his designation as chairman of the board followed the retirement of **Lammot du Pont** from the latter post. In addition to assuming the presidency of the company, Mr. Greenewalt became chairman of the executive committee, of which he had previously been vice chairman. Mr. du Pont will continue as a member of the board, while Mr. Carpenter retains his membership on the finance committee. **Walter J. Beadle,** a vice president and member of the board, resigned as treasurer of the company and was elected to membership on the executive committee. **T. C. Davis,** who had been first assistant treasurer, was elected treasurer to replace Mr. Beadle.

Henry O. Parsons has joined the chemical staff of the Tariff Commission. Formerly he was with the Bonneville Power Administration, and prior to that with the Census Bureau.

Lewis C. Wallace, formerly with Diamond Alkali Co., Painesville, Ohio, has joined the staff of Southern Research Institute, Birmingham, Ala., where he will do research work in wood chemistry.

David H. Dawson, director of sales of the pigments department of the Du Pont company, was awarded the honorary degree of Doctor of Engineering by the Drexel Institute of Technology at the institution's founder's day convocation in December.

W. H. Bahlke and **D. P. Barnard,** associate directors of research, have been named by Standard Oil Co. (Indiana) to the newly established positions of research coordinators. Dr. Barnard will continue his liaison activities connected with product quality and with technical developments in the automotive and aviation industries. Dr. Bahlke will coordinate the company's development work in the rapidly expanding field of chemicals from petroleum.

Afton D. Puckett, known in the petroleum industry for his work in antiknock properties of motor fuels for the government, has joined the Du Pont company's petroleum chemicals division at the engineering laboratory at Deepwater Point, N. J.

H. Gladys Swope, chief chemist of the Allegheny County Sanitary Authority, Pittsburgh, has been elected chairman of the division of water, sewage and sanitation chemistry of the American Chemical Society. Miss Swope, who is the first woman ever chosen to head the division, succeeds **Willard W. Hodge,** senior fellow at the Mellon Institute for Industrial Research, Pittsburgh.

H. G. Swope

H. R. Coleman

H. Roger Coleman has joined the staff of Evans Research & Development Corp., New York. Mr. Coleman, in addition to liaison activities between the corporation's laboratory and its clients will devote considerable time to technical market surveys. He formerly was manager of the special products division of General Aniline and Film Corp., and more recently has been an independent consultant in powder metallurgy.

H. B. Mann, formerly southern manager for the American Potash Institute, has been appointed vice president of the Institute. Dr. Mann assumed

COMPOSITION

Zircon (Zirconium Silicate) $ZrSiO_4$ . . 67% ZrO_2+33% SiO_2

MECHANICAL, THERMAL, CHEMICAL AND PHYSICAL PROPERTIES

Crystal Structure	Tetragonal
Molecular Weight	183
Molecular Volume	38.7
Moh's Hardness	7.5
Thermal Conductivity cal/°C/sec/cm/cm² (up to 700°F=0.031 Watts/in²/in/°F)	0.0046
Refractive index Ne	1.94-2.02
Refractive index for No	1.92-1.96
Birefringence	0.045-0.058
Mean Specific Heat (21-51°C)	0.132
Softening Point	3452°F
Melting Point	4622°F
Thermal Expansion (mean reversible 20°-1000°C)	4.5×10^{-6}/°C

Insoluble in aqueous alkaline solutions and in all acids except hydrofluoric (slightly soluble).

ELECTRICAL PROPERTIES

Dielectric Constant E		12±1
Resistivity at °F in Megohms/in³	1100°	170
	1200°	120
	1300°	70
	1400°	25
	1500°	7
	1600°	2.5

Properties of Zirconium Silicate, developed by over 30 years of TAM research, find large scale usage in a range of applications. Increasing tonnages are used in the manufacture of dry process and porcelain enamel frits. For opacification and craze resistance of ceramic glazes, $ZrSiO_4$ also finds volume application. It is used extensively in acid and electrical resisting cements and in the manufacture of high temperature and special refractories. Its high mechanical strength and thermal shock resistance make it ideal as a body constituent in certain electrical porcelains. As a mold and core wash ingredient and as a mold material in precision alloy castings and kiln furnace coatings, there is a mounting demand for Zirconium Silicate.

TAM

TITANIUM ALLOY MANUFACTURING COMPANY

Executive Offices: 111 Broadway, New York City *General Offices and Works:* Niagara Falls, N. Y.

Coming soon!

THE NYLON GAUGE MOVEMENT—another revolutionary new development by Ashcroft.

Exhaustively field-tested and employing well established engineering principles, this new movement outwears and outperforms any other gauge movement even under the most severe conditions of vibration and pulsation.

NYLON, with its low coefficient of friction, high resistance to shock loading, and its vibration-absorbent characteristics, far surpasses the wearing qualities and corrosion resistance of anything heretofore available as a material for pressure gauge movements.

Watch for the announcement. Ashcroft Duragauges will soon be available with the NYLON movement.

Stocked and sold by leading Distributors everywhere . . . When you order gauges, insist on ASHCROFT . . . Write for booklet.

ASHCROFT *Gauges*

A Product of

MANNING, MAXWELL & MOORE, INC.
BRIDGEPORT 2, CONNECTICUT

Makers of Ashcroft Gauges, Hancock Valves, Consolidated Safety and Relief Valves and 'American' Industrial Instruments.

his new duties at the Institute's headquarters in Washington last month.

John T. Rushton, with Weyerhaeuser Timber Co. for the past two years and formerly with Standard Oil Co. (N. J.), has been appointed general superintendent of the firm's new plywood plant.

Curtis F. Gerald, recently a research chemical engineer with Universal Oil Products Co., has accepted an assistant professorship of chemical engineering at the University of Washington, Seattle.

H. C. Peinert has been promoted to production manager of the high explosives section of the Du Pont company's explosives department. **W. D. Garwood,** production superintendent at the Repauno Plant, Gibbstown, N. J., has been named production manager of the special products and black powder section, succeeding Mr. Peinert.

D. L. McCollum

P. E. Rice

Donald L. McCollum has been appointed manager of reclaimed rubber in the Naugatuck chemical division of U. S. Rubber Co. **Philip E. Rice** has returned to his former position as factory manager of the Naugatuck chemical plant. Mr. McCollum was factory manager during the war period when Mr. Rice managed synthetic rubber plants in Los Angeles and Institute, W. Va.

J. C. Warner, professor and head of the department of chemistry and dean of graduate studies at Carnegie Institute of Technology, has been appointed as an assistant director of the college of engineering and science. Dr. Warner will continue as head of the chemistry department and of graduate studies.

Harold E. Graves has been appointed head of the chemical engineering department of Rhode Island State College, Kingston, succeeding **T. Stephen Crawford,** now dean of the school of engineering. The appointment becomes effective July 1. Dr. Graves

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- Cakes come away easily
- Reduces gumming
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- May be used with hydrocarbon solvents
- Non-capillary
- Better filtration
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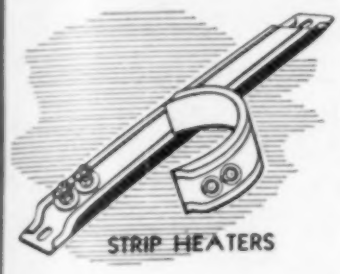
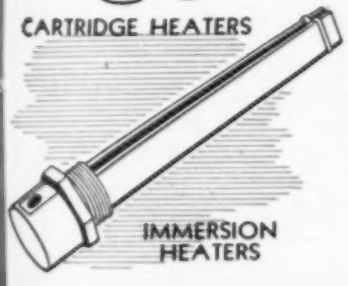
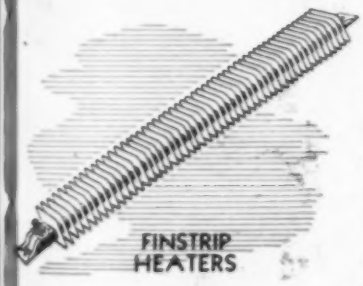


STRIP HEATERS

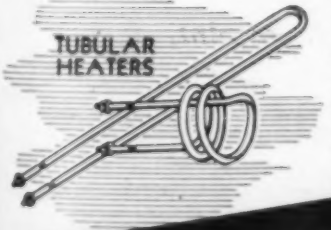
CARTRIDGE HEATERS



IMMERSION HEATERS



FINSTRIP HEATERS



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HEAT—Made to Order

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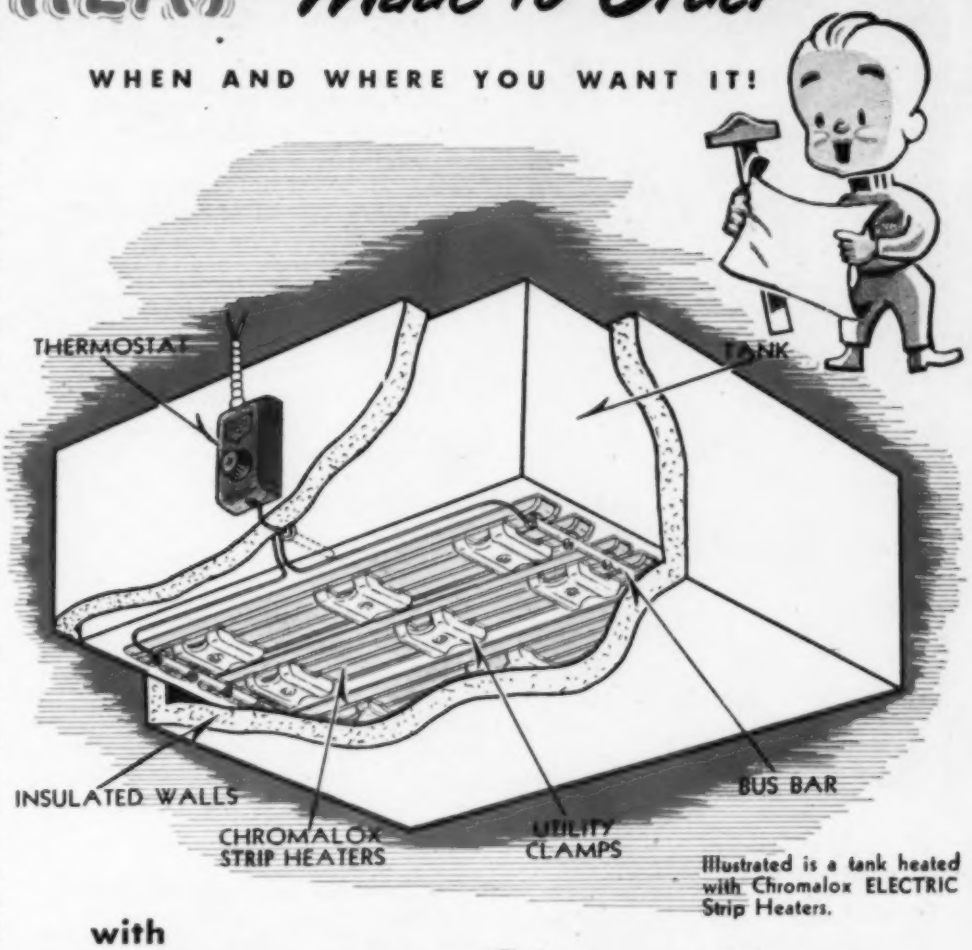

Illustrated is a tank heated with Chromalox ELECTRIC Strip Heaters.

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CHROMALOX *Electric* Heaters

• FAST—CHROMALOX *Electric* Heaters give you instant heat in the exact spots where it is needed without unnecessary heat-losses. They quickly build up to desired working temperatures.

• UNIFORM—Close operating temperatures, accurately maintained through thermostatic or manual controls, assure you uniform products.

• DEPENDABLE—Performance proved CHROMALOX Units provide efficient day-in-and-day-out service at low initial-cost, low operating-costs and minimum maintenance-attention.

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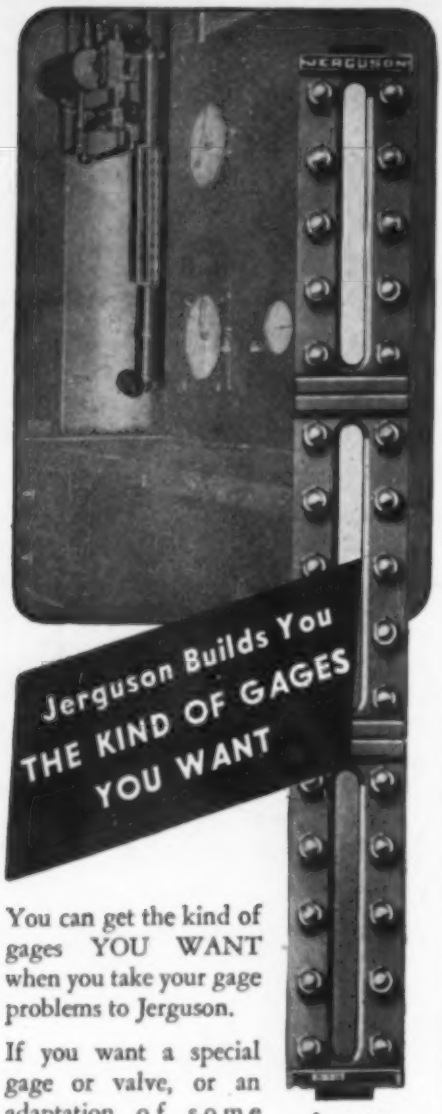
The booklet "100 Ways to Apply Electric Heat" and Chromalox Catalog 42 contain a wealth of informative data on the use of electric heat in industry. Send for your copies today.

IC-28



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Standard gages and valves, of course, are available at Jerguson's in the most complete and varied line offered anywhere.

Chemicals that raise havoc with ordinary gages can be handled with Jerguson special material and lined gages.

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was formerly research chemist for the Calco Chemical Co., Bound Brook, N. J., previously teaching at Mississippi State College and at Yale. He joined the faculty of Worcester Polytechnic Institute in 1942 and is professor of chemical engineering there.

William H. Ward has been elected a vice president of E. I. du Pont de Nemours & Co. He was formerly general manager of the explosives department. The promotion caused changes in several positions of the department: (1) general manager, (2) assistant general manager, (3) manager, explosives division, (4) director of production, explosives division and (5) division production manager. Personnel advancements were: **Harry F. Brown** from (2) to (1), **Philip J. Kimball** from (3) to (2), **Fred R. Wilson** from (4) to (3) and **T. R. Carlson** from (5) to (4).

Charles K. Shrewsbury, head of research in agricultural and organic chemistry at the Midwest Research Institute, Kansas City, Mo., has been elected chairman of the Kansas City section of the American Chemical Society. Dr. Shrewsbury succeeds **Calvin Vander Werf** of the University of Kansas.

C. O. Reiser has been appointed head of the chemical engineering department of the University of Idaho. Also announced is the appointment of **Lowell A. Jobe** as assistant professor of chemical engineering.

Herbert E. Silcox has been named assistant director in the developmental research department of Merck & Co., Rahway, N. J. Since 1943 Dr. Silcox has been head of the chemical engineering development section of the company's research and development division.

Lewis Mims, vice president of Freeport Sulphur Co., retired from the company last month. He was in charge of the company's Houston office, which the company closed after his retirement. Mims had been with Freeport Sulphur Co. since 1916.

Tom K. Smith, Jr., has been appointed assistant branch manager of the phosphate division of Monsanto Chemical Co.

L. W. Piester has joined the Columbia chemical division of Pittsburgh Plate Glass Co. as a chemical engineer in the development department at the firm's Natrium, W. Va., plant.

Erwin G. Somogyi has been appointed to the newly created position of

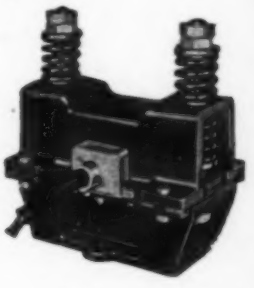
"tattle-tale"

Hammer Marks on Your Bins and Hoppers?

That tell of lost man-hours and slowed-up production?

SYNTRON
"Pulsating Magnet"

ELECTRIC VIBRATORS



Keep Bins, Hoppers and Chutes Open and Free-Flowing

—by controlled, pulsating vibrations that penetrate the mass—activate each particle and break down arching and plugging.

Eliminate pounding and poking.

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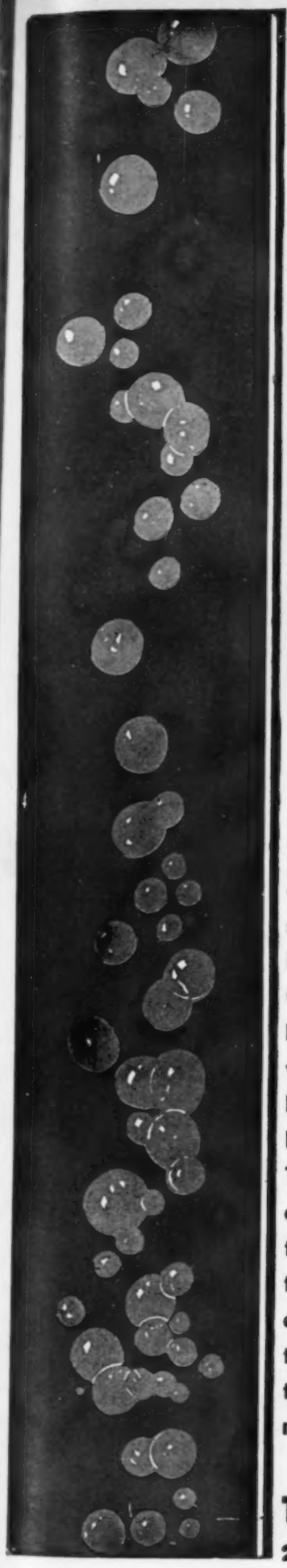
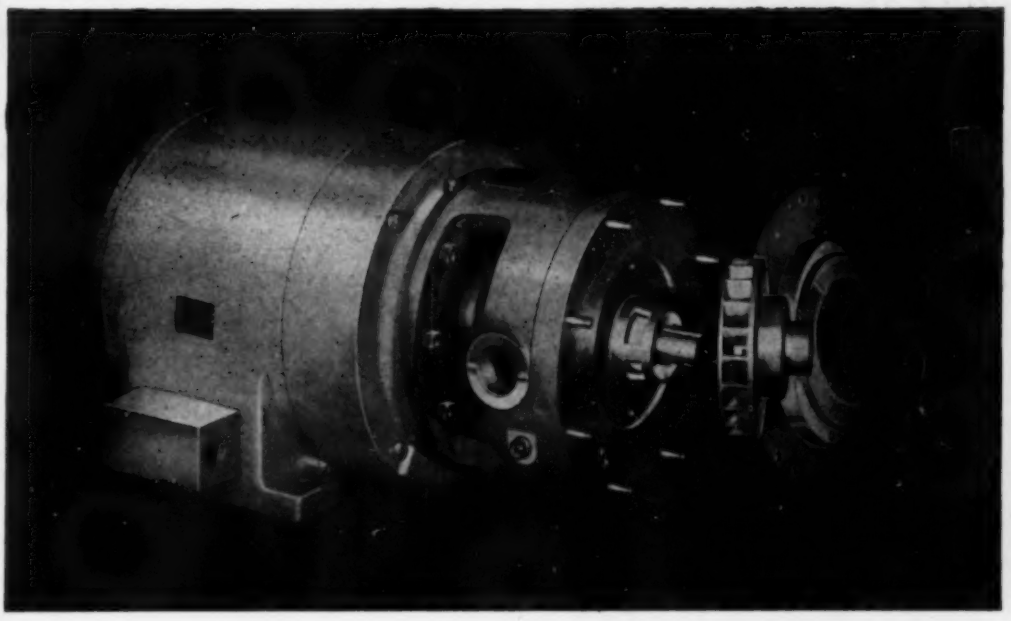


ONLY CLEAN AIR CAN REACH YOUR PRODUCT FROM A NASH COMPRESSOR



Here is a compressor designed perfectly to meet the needs of the Food Plants. It is simple, for it has only one moving part, a rotor cast in one piece and rotating in the casing without metallic contact. This means trouble-free operation over long periods. It is compact and requires little valuable floor space. Its oversize ball bearings seldom require attention or lubrication. No lubrication is required in the interior, so that the air is kept clean from the time it enters the pump. • But this is not all. The compressing medium in the Nash Pump is a rotating column of clean water. The air is in intimate contact with this water in passing thru the pump and is actually scrubbed while it is being compressed. Dust present in the atmosphere is removed, and the air delivered free from dirt, oil, or heat, without the use of scrubbers or air washers. Think what this means in terms of purchase cost and floor space occupied by complicated air washing apparatus. • These pumps are proving their worth in the most trying service. They are ideal for transferring beer or wort from tank to tank by air pressure, for maintaining pressure on aging tanks, for supplying compressed air to bottling machines in racking, etc. • Available in any capacity, these pumps deliver pressures up to 40 lbs. absolutely uniform without storage tanks. • You want the most reliable pumping equipment in your plant, so by all means find out more about the Hytor. Our catalog No. 217 is free on request.

THE NASH ENGINEERING COMPANY

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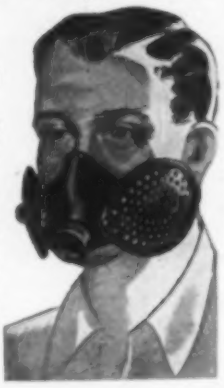
FREE BREATHING without DANGER or DISCOMFORT

. . . that's workers' experience with CESCO Respirators

No. 94 Healthguard Respirator

Efficiently filters out lead, silica and nuisance dusts, through throw-away paper filters. Speaking diaphragm permits normal conversation. Pliable, seal-tight rubber with broad easy-resting facial contact for comfort; adjustable head-bands. Bureau of Mines Approval, No. 2116.



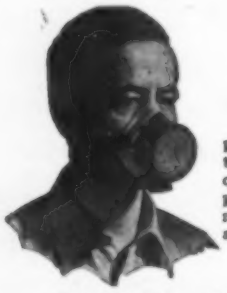
● For protection from dust or fumes . . . prescribe CESCO Respirators for your workers.

Your prescription is supported by two important advantages: First, CESCO Respirators permit *free breathing*, at the same time giving workers *full protection* from dust and fume dangers. Second, CESCO Respirators are worn with minimum interference with normal comfort—every possible comfort feature is incorporated into CESCO products.

This combination—assured safety and maximum comfort—makes CESCO Respirators especially popular with wearers. That's why your best buy is CESCO.

No. 95 Fume Respirator

Cartridge-type respirator for protection from light gas and vapor concentrations. Rubber face cushion shapes to varying facial contours, provides air-tight seal, comfortable fit.



No. 80 Dust Respirator

Lightweight diaphragm-type dust protector; contains large, quickly-changed filter pads. Made of molded rubber, with replaceable, soft cloth facelet.

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CESCO
FOR SAFETY

assistant director of research of the plastics division of Monsanto Chemical Co., Springfield, Mass., in charge of process development. He will be in charge of pilot plant operation, small product manufacture, mechanical development and research engineering.

T. S. Petersen, formerly vice president and director, has been elected president of Standard Oil Co. of California. He succeeds **R. G. Follis,** president since 1945, who has been elected vice chairman of the board of directors.

John H. Heuer has been named assistant to the technical director of the printing, publication and converting paper division of the St. Regis Paper Co. with his headquarters at the central laboratory of the company at Deferiet, N. Y.

W. E. Hanford has been appointed to the newly created post of director of petroleum and chemical research of the M. W. Kellogg Co.

Aaron Addelston, formerly associate director, has been made director of the special chemicals division of Winthrop-Stearns Inc., New York.

J. E. Hansen, director of technical service of Ferro Enamel Corp., Cleveland, Ohio, and member of that firm for the past 22 years, has been transferred to Los Angeles where he will have complete charge of Ferro's California manufacturing operations.

J. Clark Johnson has resigned as chemical engineer in the electrotechnical laboratory, U. S. Bureau of Mines, Norris, Tenn., to accept employment as chemical engineer, research department, chemical pulp division, Buckeye Cotton Oil Co., Memphis.

F. S. MacGregor has retired as geneneral manager of the electrochemicals department of E. I. du Pont de Nemours & Co. The vacancy caused several position changes in the department: (1) general manager, (2) assistant general manager, (3) director of the technical division, (4) director of production, (5) manager of the Niagara Falls plant and (6) assistant manager of the Niagara Falls plant. Individual advancements were: **Samuel G. Baker** from (2) to (1), **Donald O. Notman** from (3) to (2), **E. A. Harding** from (4) to (3), **Russel L. Hardy** from (5) to (4) and **N. C. Jones** from (6) to (5).

Emil Heuser has retired from his active duties as head of the cellulose division of the Institute of Paper Chemistry and has become group

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REFRASIL

FIBROUS SILICA

WILL IT SOLVE A PROBLEM FOR YOU IN ANY OF THESE USES?

AS INSULATION FOR: high temperature power equipment; hot gas ducts; electrical wire and equipment; electric muffle furnaces . . . As a covering for thermo-couple lead wires . . . As a catalyst or catalyst support . . . As incombustible long-life wicking material . . . As a chemically stable, versatile material, the full extent of usefulness of which is only now being realized. Refrasil, originally developed for aircraft jet insulation, has such exceptional properties as . . .

- ★ WITHSTANDS 2000°F. INDEFINITELY
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- ★ RESISTANT TO VIBRATION
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AVAILABLE IN THESE FORMS:

BATT, in rolls approximately 14′x3½′x3/16″ thick; CLOTH in rolls of random lengths approximately 32″ wide x 0.015″ thick; TAPES—SLEEVINGS—CORDAGE, in various sizes and lengths; BULK, in loose fibers; PREFABRICATED BLANKETS, to specification either permanent or removable.

WRITE . . .

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Important FACTS ABOUT pH for PROFIT-MINDED EXECUTIVES

WHETHER you are an executive responsible for planning long-range plant production, or for obtaining maximum efficiency from present processing operations, one of the most important advancements you can make is the installation of BECKMAN pH CONTROL. Through the proper application of modern pH control you can make *many* vital savings . . . savings that will quickly pay for the installation and will *continue* paying big dividends throughout the years. For example, some of the many benefits resulting from Beckman pH Control include . . .

. . . saving valuable chemicals through more accurate control of dosages.
. . . reducing costly corrosion by pre-regulating acid and alkaline solutions.
. . . speeding up process operations by operating at optimum pH values.
. . . minimizing rejects by increasing the uniformity of process solutions.
. . . *and many other important savings in time, materials and plant operating costs.*

BUT TO MAKE CERTAIN you get the latest, most convenient and most accurate pH equipment available, be sure to specify "BECKMAN"...

Beckman pH equipment is completely electrometric, eliminating the mess and inaccuracies of colorimetric methods. Simply press a button and the exact pH of any process is instantly shown on a large easily-read dial. *It is the simplest of all pH methods!*

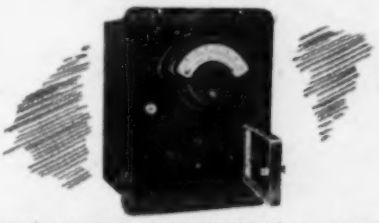
The accuracy of Beckman pH readings is completely unaffected by human errors in color judgment, by turbidity, oxidizing or reducing agents, by suspended materials, colored process solutions or other variables that affect outmoded colorimetric methods. *Beckman pH readings are universally accurate and dependable!*

With Beckman equipment no time-wasting or troublesome sampling devices are needed. Beckman pH electrodes may be installed directly in vats, tanks, channels or flow lines—and exact pH values read instantly—and continuously, if desired—on the process fluids themselves.

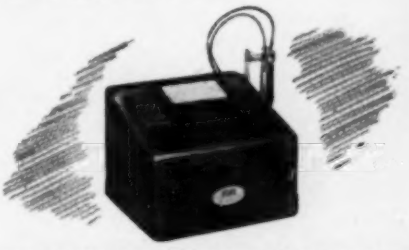
Unique rugged-type Beckman Electrodes, specially designed for direct immersion in abrasive or suspension-laden fluids, reduce maintenance to an absolute minimum. *Beckman is the most trouble-free of all pH equipment!*

The above are only a few of many Beckman advantages. Beckman pioneered the modern glass electrode pH instrument . . . pioneered the first completely automatic pH indicator, recorder and controller . . . pioneered High Temperature Glass Electrodes which can be used continuously at temperatures as high as 212° F. (100° C.) . . . pioneered High pH Electrodes which permit accurate measurements of high pH values even in the presence of sodium ions . . . and pioneered many other vital advancements. In fact, Beckman is the only pH equipment embodying every modern advancement in the field of pH!

THERE'S A BECKMAN pH INSTRUMENT FOR EVERY NEED



COMPLETELY AUTOMATIC! The Beckman Model R instrument operates directly from standard 110 v. A.C. lines to provide completely automatic pH indication. Also provides for completely automatic pH recording and automatic process control. Can be installed to give accurate pH readings from various stations in plant through one instrument. *This is the pH unit being installed by today's most modern plants, large and small.*



PORTABLE A.C. OPERATION! The Beckman Model H instrument can be quickly moved from one part of the plant to another and plugs directly into standard 110 v. 50/60 cycle A.C. current. Compact, convenient and extremely simple to operate, the Model H gives instant pH readings on an easily-read dial. It is widely used both for manual pH control of small plants and as an auxiliary instrument on completely automatic pH installations.

COMPLETELY SELF-CONTAINED! The Beckman Model M is the ideal pH instrument where *complete* portability is desired. Operating from its own self-contained, long-life power supply, the Model M can be used anywhere in the plant or field, whether convenient to power lines or not. Features the same accuracy, simplicity and operating speed as the Model H, and is also widely used both for manual pH control of small plants and as auxiliary equipment on large automatic installations.

Write for literature on Beckman pH Equipment!

BRING YOUR pH PROBLEM TO US. Our trained engineers will gladly study your problem and recommend the equipment best suited to your particular requirements. No obligation, of course.

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The picturesque and progressive city of Rolla, Missouri, has assured itself of much greater residential, business and industrial growth by adding the fourth Layne Well Water Supply unit, to step their daily water capacity up to 2,500,000 gallons. In purchasing these carefully designed and precision built wells and pumps, the city has made an excellent financial investment. Operating at an unusually low cost, their Water System will show a substantial annual profit. Furthermore, their Layne Wells and Pumps will probably need only very minor repairs for years and years. Layne Well Water Supply Systems, whether installed for cities, factories, railroads, chemical plants, refineries or irrigation projects, can be depended on to give outstanding satisfaction. For further facts, address LAYNE & BOWLER, INC., General Offices, Memphis 8, Tennessee.

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leader emeritus and consultant in cellulose chemistry. Dr. Heuser will take up residence in California.

Richard O. Zerbe is director of the newly created development department at the Monsanto Chemical Co. plant in Nitro, W. Va.

Jim L. Huitt has been appointed to the Aluminum Co. of America Fellowship in the school of chemical engineering at the University of Oklahoma.

J. L. Huitt P. Weller

Paul Weller is now director of market research of Wyandotte Chemicals Corp.

Lester L. Stout, former member of the technical laboratory of the organic chemicals department, E. I. du Pont de Nemours & Co., Boston, has been appointed assistant to the director of the Ohio State University Research Foundation.

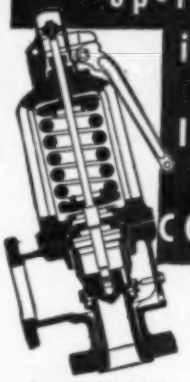
Linus C. Pauling, chairman of the division of chemistry and chemical engineering of the California Institute of Technology and one of the world's leading theoretical chemists, has been elected president of the American Chemical Society for 1949.

John B. Challies, vice president, Shawinigan Water and Power Co., Montreal, has received an honorary membership in the American Society of Civil Engineers. He has been a leader in conservation and use of Canadian water resources, especially for electrochemicals.

B. S. Liles, head of research, experimental and development work of the Carolina Aluminum Co., Badin, N. C., has been elected chairman of the Carolina-Piedmont section of the American Chemical Society for 1948. He succeeds **Dave E. Truax** of Steil, Hall & Co., Charlotte.

R. Winston Liggett has joined the staff of the research and development division of the American Sugar Refin-

NOW... up-to-the-minute information on INDICATORS and CONTROLLERS



—A practical manual packed with sound solutions to metering and control problems

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INSTRUMENT and CONTROL MANUAL for Operating Engineers

By EUGENE W. F. FELLER

Operating Engineer; Associate Editor, *Power*

● Here is an up-to-date guidebook for the man in the plant who wants fingertip information on the principles of control, and on the construction and operation of indicators and controllers of all types. It describes and illustrates the most modern instruments for measuring and controlling liquid levels, pressure, temperature, speed, and humidity — it provides trouble-shooting data that enables you to keep control systems functioning with a minimum of error and time-loss.

Over 500 drawings and charts 426 pages

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16 thorough chapters cover operation and maintenance of indicators and controllers—

1. Simple Liquid-level instruments
2. Pressure Elements
3. Head Meters
4. Temperature Elements
5. Characteristics of Motor-operated Valves
6. Self-operated Pressure Valves
7. Temperature Valves
8. Hygrostats and Psychrometers
9. Control Mechanisms
10. Control Systems
11. Controller Applications
12. Emergency Instruments
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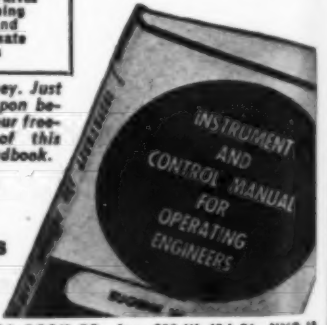

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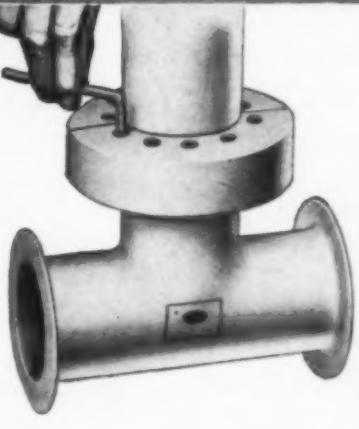

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ing Co. of Philadelphia. Dr. Liggett, who was formerly associated with the A. E. Staley Manufacturing Co., will be in charge of the chemical section of the division. Other new members of the staff include: **S. G. Hindin** previously with the Houdry Process Corp. of Pennsylvania; **H. H. Malkin** formerly of the Barrett Division of Allied Chemical and Dye Corp.; and **C. L. Osterman** formerly of Publicker Industries, Philadelphia.

Louis A. Oberly has resigned as research director for the Hartford Rayon Corp. He is now associated with the research staff of Industrial Rayon Corp., Cleveland, Ohio.

Howard Kehde, formerly of Union Oil Co. of California, is now with Foster Wheeler Corp. in charge of process engineering of hypersorption units.

OBITUARIES

Harry L. Frevert, director of the Midvale Co. and president from 1931 to 1944, died on December 11.

Stroud Jordan, 62, industrial chemist in charge of the manufacturers' service division of the American Sugar Refining Co., died at his home in Miami, Fla., December 28.

Harral O. Pierce, manager of the Charlotte, N. C., branch office of Solvay sales division, Allied Chemical & Dye Corp., died December 28.

Frederick P. Huston, 57, engineer and metallurgist in the development and research division of the International Nickel Co. died in Plainfield, N. J., December 29.

Peter S. Gilchrist, 86, internationally known chemical engineer, died at his home in Charlotte, December 30.

W. J. Woodcock, 49, director of John Bull Rubber Co., Ltd., Evington Valley Mills, Leicester, England, died January 1.

Brice S. Hull, Pittsburgh branch manager of Solvay sales division, Allied Chemical & Dye Corp., died suddenly of a heart attack on January 2.

Leon A. LeGrassie, 60, mechanical and chemical engineer who did experimental and development work in chemistry for U. S. Government in both World Wars, died in Cleveland, January 4.

Bjarne Johnsen, 63, for the past 30 years director of the Hamermill Paper Co. laboratories, died January 9.

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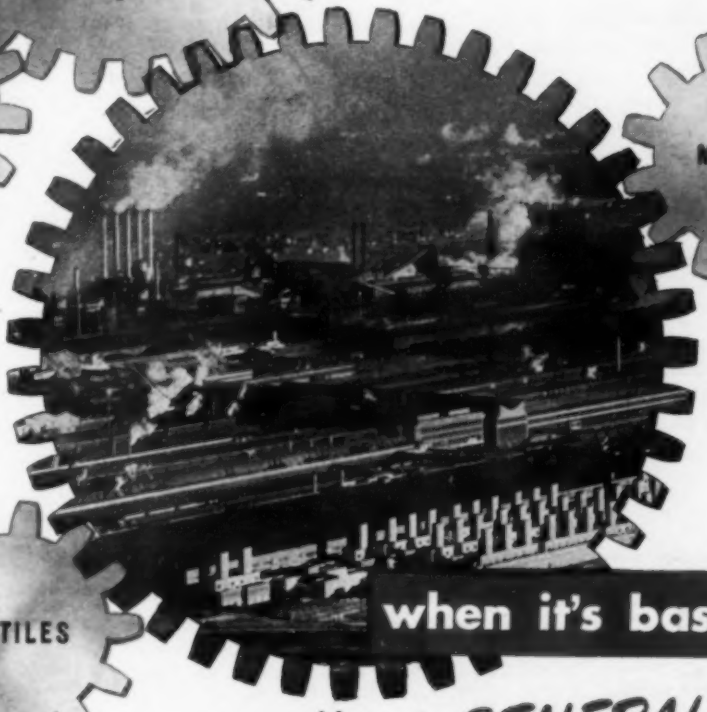

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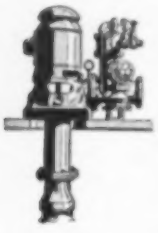

Install this versatile Peerless Vertical Turbine type Fire Pump, with proper fittings, for a permanent and reliable water supply for adequate plant fire protection. *Underwriters approved*, these pumps produce from 500 to 2000 g.p.m. against heads to 285 ft. Extremely simplified in piping arrangement.

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INDUSTRIAL NOTES

American Cyanamid Co., Bound Brook, N. J., has made Lawrence H. Jones sales representative in the Chicago territory for the pigment department, Calco chemical division.

Titeflex, Inc., Newark, N. J., has named Robert E. Carbauh sales manager of a new department for the development and promotion of fire control equipment.

Monsanto Chemical Co., St. Louis, Mo., has appointed Edwin L. Hobson sales manager of thermoplastic molding materials.

United States Steel Corp., Chicago, has announced the appointment of R. F. Sentner, assistant sales vice president; R. Conrad Cooper, industrial engineering vice president; and M. W. Reed, chief engineer of U.S. Steel of Delaware.

Allis-Chalmers, Milwaukee, has named E. T. Cuddeback manager of the Tampa district office.

Monsanto Chemical Co., St. Louis, Mo., has transferred James P. Mahoney from the Merrimac division at Everett, Mass., to organic division sales in St. Louis. He will be in charge of Merrimac division sales and sales development.

United Electric Controls Co., Boston, has moved their office and production facilities from South Boston to 85 School St., Watertown, Mass.

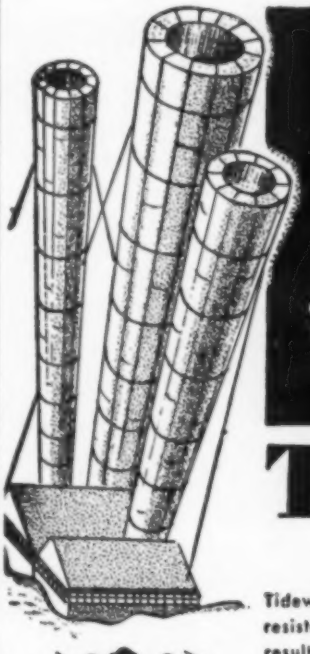
American Cyanamid Co., Bound Brook, N. J., has appointed Ralph M. Fischer manager of technical service, textile resin department.

Tracerlab Inc., Boston, has appointed Alan P. Schreiber to the sales staff.

United States Foreign Corp., New York, has named Boyce Tuten manager of the chemical department.

Rapids-Standard Co., Inc., Grand Rapids, Mich., has moved the sales and advertising departments to enlarged quarters at the Rapistan Bldg.

Air Reduction Co., New York, has formed a new wholly owned subsidiary, the Air Reduction Pacific Co., with headquarters at 220 Bush Street, San Francisco. H. P. Etter is president and director. Other directors are C. D'W Gibson, G. E. Hawkins, J. A.



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RED CYPRESS

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The Wood Red Cypress "The Wood Eternal"

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New developments have made a big difference in low temperature insulation. Get these facts before you buy. Learn why KOLDBOARD gives you more . . . saves you more.

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3. KOLDBOARD for high efficiency! Koldboard keeps low temperatures as you want them—thanks to a felted construction that holds millions of extra dead air cells. Thermal conductivity at 50° F., for example, is only 0.29 btu per square foot per hour per degree F.

4. KOLDBOARD is moisture resistant! Enemy No. 1 of insulation is infiltration of moisture vapor. But, this is no problem with Koldboard—even on outdoor installations. At Federal Specification test conditions, Koldboard shows moisture absorption of only 0.68%.

When you specify insulation for refrigerated plants—get the insulation that gives you ALL 4 BIG FEATURES—BALDWIN-HILL KOLDBOARD. It can be installed quickly, economically in either a new or an existing plant. High thermal efficiency means uniform temperatures, rock bottom operating cost. Best of all, it's insurance against fire. See for yourself why KOLDBOARD does such an efficient, economical insulating job.

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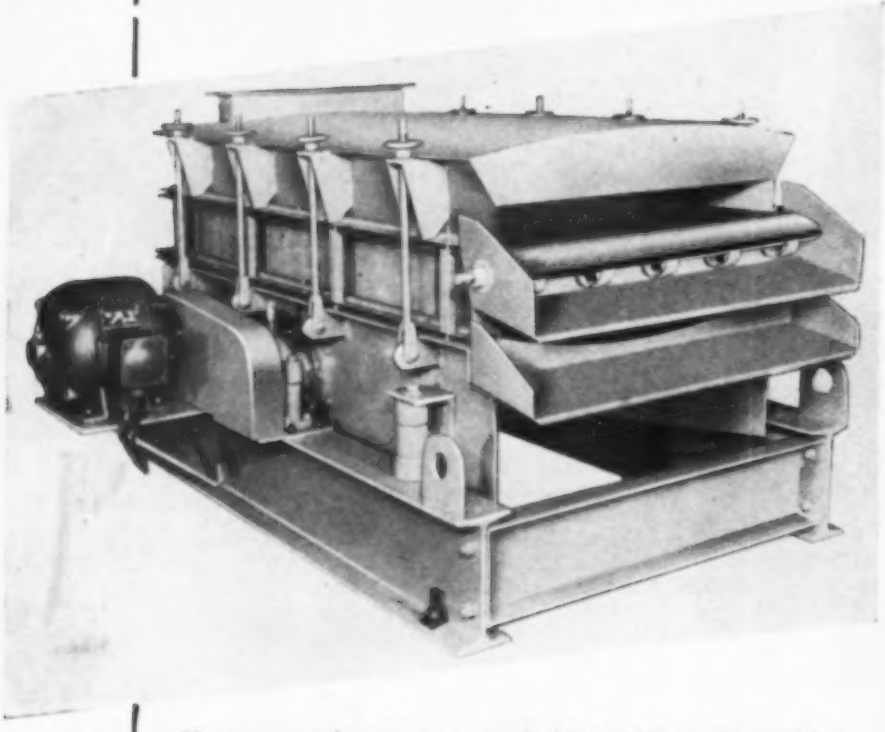
simplicity gyrating screens speed sizing and dewatering of chemical products



If you want faster, more profitable, 100% sanitary sizing and dewatering of materials in your processing, it will pay you to investigate Simplicity Gyrating Screens. They handle a wide variety of materials and greatly increase production through the efficient Simplicity gyration. For example, in a starch plant a 2-tray Simplicity screen with 150 mesh cloth screens 180 gallons of starch fluid per minute. In a soap plant, a 4′ x 8′ Simplicity Single Deck Screen equipped with $\frac{1}{16}$″ slotted opening cloth can screen 31,256 lbs. of powdered soap per hour, with no blinding, minimum balling, and only 4% tailings. Many plants are eliminating their stream pollution problems by passing waste through Simplicity Screens to remove solids before dumping.

Simplicity Gyrating Screens for the chemical products industry are made with 1, 2, 3, and 4 trays that are easily accessible for cleaning. There are no hidden corners or obstructions to collect dirt. Discharge spouts may be open or totally enclosed. Mild steel, 188 stainless, or 316 stainless steel construction. Send us particulars of your sizing and dewatering operations and our engineers will recommend specific Simplicity equipment that will do more and better work for you in less time and at lower cost.

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Hill, C. G. Andrew and W. C. Keeley, who is also chairman of the board.

Meer Corp., New York, is the new name for E. Meer & Co., Inc.

Alkydol Laboratories, Inc., Cicero, Ill., has appointed Hukill Chemical Corp., Cleveland, as sales representative.

Reliance Electric & Engineering Co., Cleveland, has named W. C. Madsen branch manager of the Gary, Ind., office.

Pennsylvania Flexible Metallic Tubing Co., Philadelphia, has elected Samuel H. Collom, Jr., executive vice president in charge of production.

International Nickel Co., Inc., New York, has elected R. D. Parker, J. Roy Gordon, and Herbert G. Fales, assistant vice presidents of the International Nickel Co. of Canada, Ltd. Walter C. Kerrigan, James F. McNamara and T. H. Wickenden were elected vice presidents of the United States subsidiary.

Raybestos-Manhattan, Inc., Passaic, N. J., has appointed P. L. Edwards assistant manager of the central district office in Pittsburgh.

American Chain & Cable Co., Inc., Bridgeport, Conn., has named Ward C. Whippo district sales manager for the Pittsburgh district of Reading-Pratt & Cady division, with headquarters at 908 Empire Bldg., Pittsburgh.

Ferro Chemical Corp., Cleveland, Ohio, has appointed Allen G. Lilla sales engineer.

Bemis Bro. Bag Co., St. Louis, Mo., has promoted Elwood M. Proctor to the post of manager of the plant at Seattle, Wash.

Pennsylvania Salt Mfg. Co., Philadelphia, has promoted Albert H. Clem to the new position of field sales supervisor. P. C. Staples, Jr., succeeds him as product supervisor of cleaners, pickling and descaling products. R. R. Pierce is now product supervisor of corrosion-resistant products.

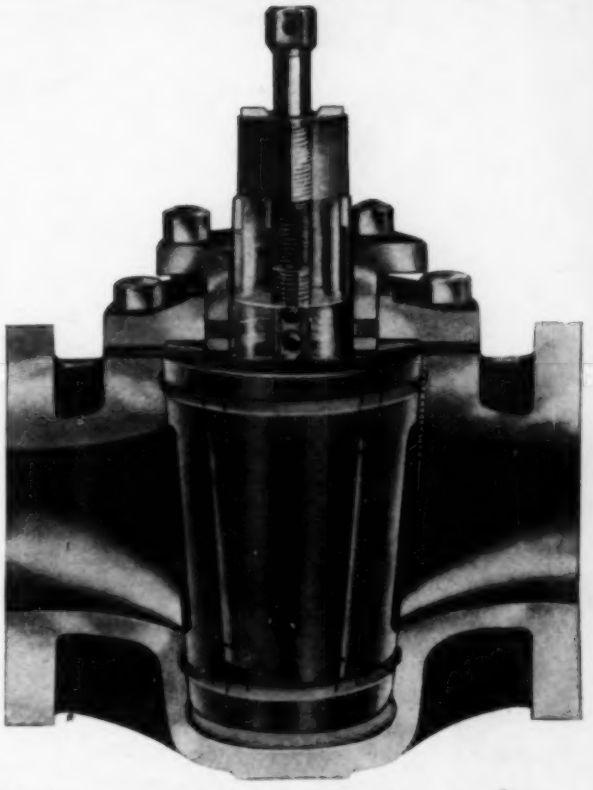
Kinetic Chemicals, Inc., Wilmington, has appointed R. J. Thompson director of sales; W. W. Rhodes, sales manager of aerosol propellants; and R. L. Williams assistant sales manager of refrigerants.

Detrex Corp., Detroit, has named W. F. Newbery assistant director of sales. LeRoy Camel is the new sales

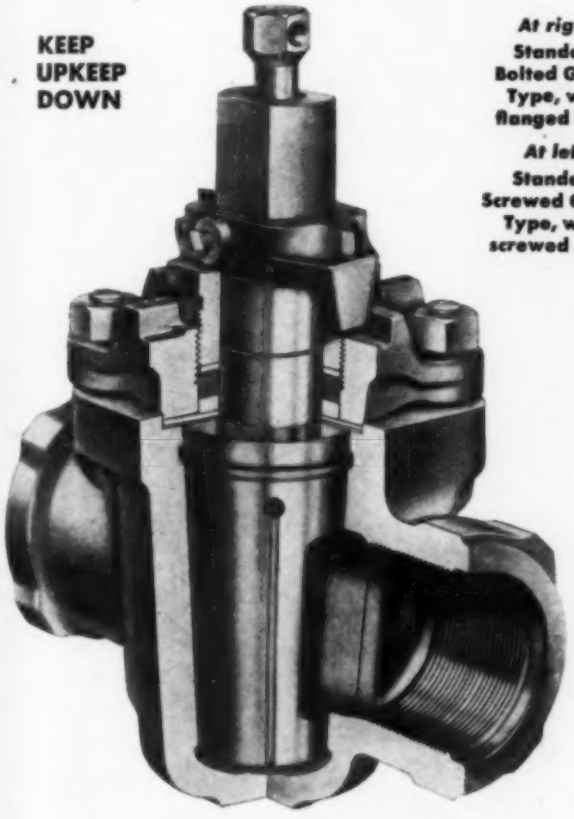
NORDSTROM VALVES CAN HANDLE *suspended solids* without affecting ease of operation

Having trouble with valve closure?

Does precipitation in line fluids clog your valves or interfere with full closure? You can avoid these troubles by installing Nordstrom valves. The lubricated plug never leaves its seat, nor is the seat exposed to the line fluid. Suspended solids flow right through the open valve; the smooth-walled interior of body and plug do not present any surface for lodgment of solids.



KEEP UPKEEP DOWN



At right: **Standard Bolted Gland Type, with flanged ends**

At left: **Standard Screwed Gland Type, with screwed ends**

Powerful shearing action of the plug when turning is further protection against the valve "salting up." In many chemical plants handling brines and heavily laden fluids, Nordstrom lubricated valves are extremely essential; also for handling sewage, foods, soda products, slurries, etc., and in refineries.

Nordstroms provide most positive closing action. A quarter-turn of the plug fully opens or closes the valve. Pressurized lubrication forms a seal around each port through which the line fluid cannot penetrate.

To meet chemical service requirements, Nordstrom valves are available in suitable metals and alloys, including semi-steel, Nordco cast steel, stainless steel, bronze, etc. Sizes: ½ in. to 30 in. For any pressure or temperature. Ask for descriptive catalog.

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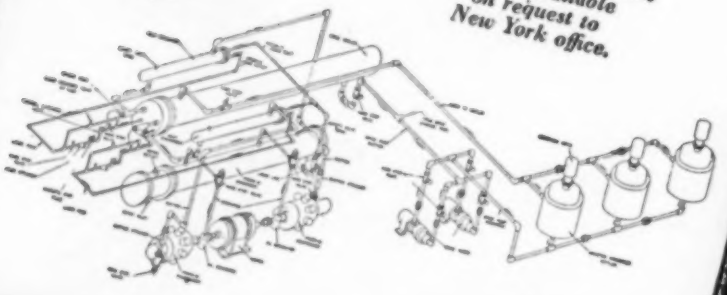
Mixing DDT Ingredients at −18° F

Enlarged copies of this layout available on request to New York office.



PATTERSON-KELLEY
Heat Exchangers AND *Process Equipment*

This cooling system, using Freon 12 for chilling calcium chloride brine which in turn chills the contents of the kettles, is indicative of the way Patterson-Kelley engineers can help process plants make effective use of heat-transfer equipment. With 3 Jacketed Kettles, a Cooler, a Condenser, and 2 Heat Exchangers of our design and manufacture, it comes close to being an all-Patterson-Kelley installation.

In planning this installation two basic problems were encountered: (1) the design of jacketed kettles to be operated at sub-zero temperatures; and (2) the design of the cooling system which would most effectively and economically provide the required low temperature.

Write us about your problems if in any way they involve Kettles, Heat Exchangers, Coolers, Condensers, Autoclaves or other heat transfer equipment.

EST. 1884

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manager of the industrial products division.

Sharp & Dohme, pharmaceutical and biological manufacturers, has opened a new 20,000 sq.ft. branch office and distributing center in Dallas, Tex., which will serve Texas, southern Oklahoma and portions of New Mexico. W. C. Newberry is the branch manager.

Champion Paper and Fibre Co. has completed the installation at Houston, Tex., of equipment to manufacture food paperboard from pulp produced at the company's Houston mill. This is part of a $6 million expansion inaugurated by Champion after the end of the war. Production of the board is approximately 100 tons per day.

Monsanto Chemical Co., St. Louis, plans to install a small plant at Decatur, Ill., moving to that city a portion of the company's Portsmouth, Va., operation which manufactures glues and adhesives.

Link-Belt Co., Chicago, Ill., has appointed Leonard C. Heinlein to the new position of assistant superintendent at the Ball & Roller Bearing division plant in Indianapolis. Columbus Basile has been appointed superintendent at the Caldwell plant in Chicago.

Foote Bros. Gear and Machine Corp., Chicago, has advanced R. B. Moir to assistant vice president in charge of engineering and product development of the industrial gear division. B. H. Quackenbush is now sales manager of this division.

United States Steel Corp., New York, has opened new coal-chemicals offices at Cleveland and Chicago. William K. Wood is in charge of the Cleveland office in the Terminal Tower Bldg. and William G. Souder will manage the Chicago office at 208 South LaSalle St.

Hewitt-Robins, Inc., New York, has organized a new division, Robins Engineers, to handle the contracting phases in the design, engineering and installation of complete material handling and processings plants. Harold Von Thadon heads the new division as vice president with headquarters at 157 Chambers St., New York.

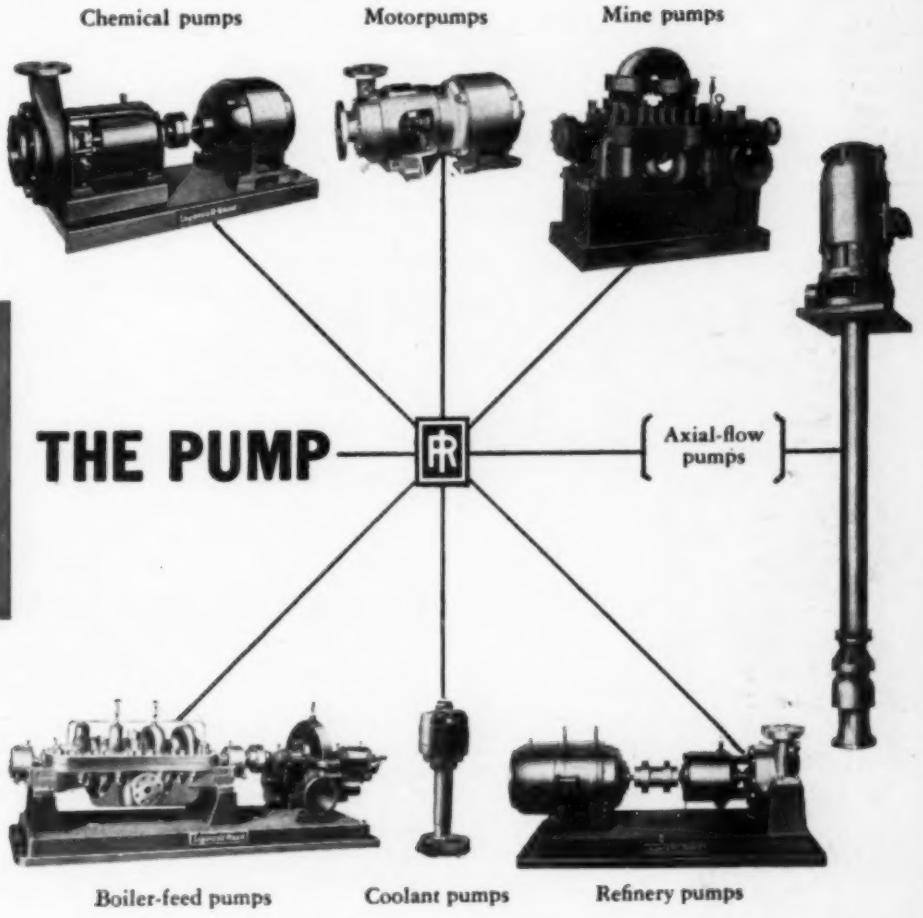
E. I. du Pont de Nemours & Co., Wilmington, Del., is expanding facilities at its Carney's Point, N. J., works for the production of sodium carboxymethyl cellulose. New facilities are expected to be completed soon.

You specify

THE FLUID, TEMPERATURE, AND PRESSURE

We'll specify

THE PUMP



Ingersoll-Rand builds pumps to handle practically all liquids used by industry—fresh water, petroleum, salt water, paper stock, boiler-feed water, alkalis, acids, and many others.

There is a size and type of pump in this line to handle most any liquid-moving problem. Furthermore, new pumps have been developed as required to meet the special needs of important new industrial processes.

Ask the Ingersoll-Rand engineer to recommend pumps to meet your conditions. Ingersoll-Rand Company, Cameron Pump Division, 11 Broadway, New York 4, N. Y.

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FOR PRODUCTS THAT CHANGE CONSISTENCY DURING PROCESSING

★ No step bearing required in tank... wide spaced anti-friction bearings on vertical shaft eliminate need.
★ Variable Speed Agitation allows processing over wide range of viscosities.
★ "Tailored" to your own manufacturing process.
★ Trouble-free! No Oil Leaks on Vertical Shaft.
★ Made of any weldable metal—A.S.M.E. Code.

Variable speed agitation may be the answer to *your* processing problem!—This new I★P★E kettle is built in sizes up to 3000 gal. and each installation is engineered to *your own* specific manufacturing requirements.

I★P★E also designs and builds complete equipment—for resin esterification, continuous neutralization, continuous organic processing, paint and varnish manufacture, etc.—and DELIVERS ON TIME.

Let I★P★E analyze your production process, make suggestions to help step up your output. We can point to engineering problems solved, attempted by few other manufacturers. Why not write, phone, wire today?

INDUSTRIAL

PROCESS ENGINEERS

"Special and Standard Process Equipment Engineered to Your Requirements"

5202 HUDSON AVE.
WEST NEW YORK, N. J.

CONVENTION PAPER ABSTRACTS

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Resins Based on Lactic Acid

IT HAS been estimated that the whey produced annually as a byproduct in the manufacture of casein and cheese is a potential source of about 400 million pounds of lactic acid. The shortage of tin and basic chemicals used by the coatings industry during the war made studies of lactic acid resin coatings appear desirable.

Chemical properties of lactic acid make it possible to form useful resins when reacted with other compounds such as aldehydes, esters, carbohydrates, fatty oils and metal salts. Heat is used to remove water from the lactic acid which then reacts with the various agents.

The most practical of these resins is formed by reacting dehydrated lactic acid with fatty oils such as castor oil, linseed oil, or modified drying oils at temperatures of about 510 to 535 deg. F. until a soft brown, elastic product is obtained. The resin is dissolved in suitable solvents to form a solution containing about 20 percent of resin. After addition of driers a lacquer is obtained which produces a hard, infusible, flexible coating when baked for 15 min. at 390 deg. F.

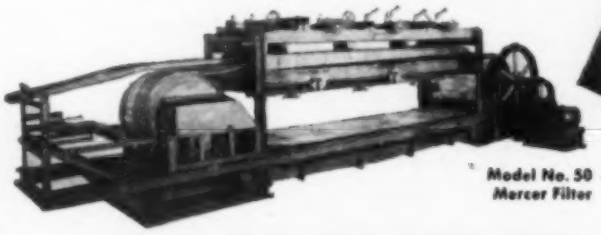
Favorable results were reported as follows by various commercial organizations in testing this resin as a metal coating. The hardness of the coating was acceptable, it was not affected by the alkalis used in dairies and its flexibility was superior to that of a phenolic coating. The coating had sufficient water and reagent resistance to warrant its use in the interior of food cans where its non-toxic and superior elastic values would be useful. This coating may be further improved by the addition of small amounts of resins derived from coal tar and petroleum.

A novel type of resin is one in which a small amount of metal (fractions of

MERCER BAND Filters

FILTRATION · WASHING · DRYING

Low-cost Efficient Continuous Suction Process



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PERFORMANCE—PROVEN FEATURES

Multiple washing zones. Evenly formed filtered cake. Varied thicknesses. Automatic cake discharge. Continuous filter medium cleansing. Low power consumption.

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1 percent to about 6 percent, is combined with polymerized lactic acid. These resins have been named metal polylactyllactates. They are made by reacting lactic acid with soluble metal salts of such metals as aluminum, chromium, cobalt, copper, iron, manganese, lead and zinc, or combinations of these metals by heating for several hours at temperatures up to 485 deg. F. These resins may also be made in a process using very little heat by the addition of reactive anhydrous metal chlorides to dehydrated lactic acid.

This type of resin may be obtained as a pale, infusible solid which is readily converted into lumps or an almost colorless powder. When dissolved in organic solvents the coatings generally air-dry rapidly, but for good water resistance should be baked for about 15 min. at 365 deg. F. Excellent light colored, tough, water resistant coatings suitable for protective and decorative purposes may be formulated. Attractive pigmented coatings baked on iron articles such as cigarette lighters and pencils have held up well while in daily use for a period of 8 months. Alone or modified with other resins, plasticizers and fillers, these metal polylactyllactates are suitable for a variety of uses.

P. D. Watson, U. S. Dept. of Agriculture, before Paint, Varnish and Plastics Division, American Chemical Society, New York, Sept. 18, 1947.

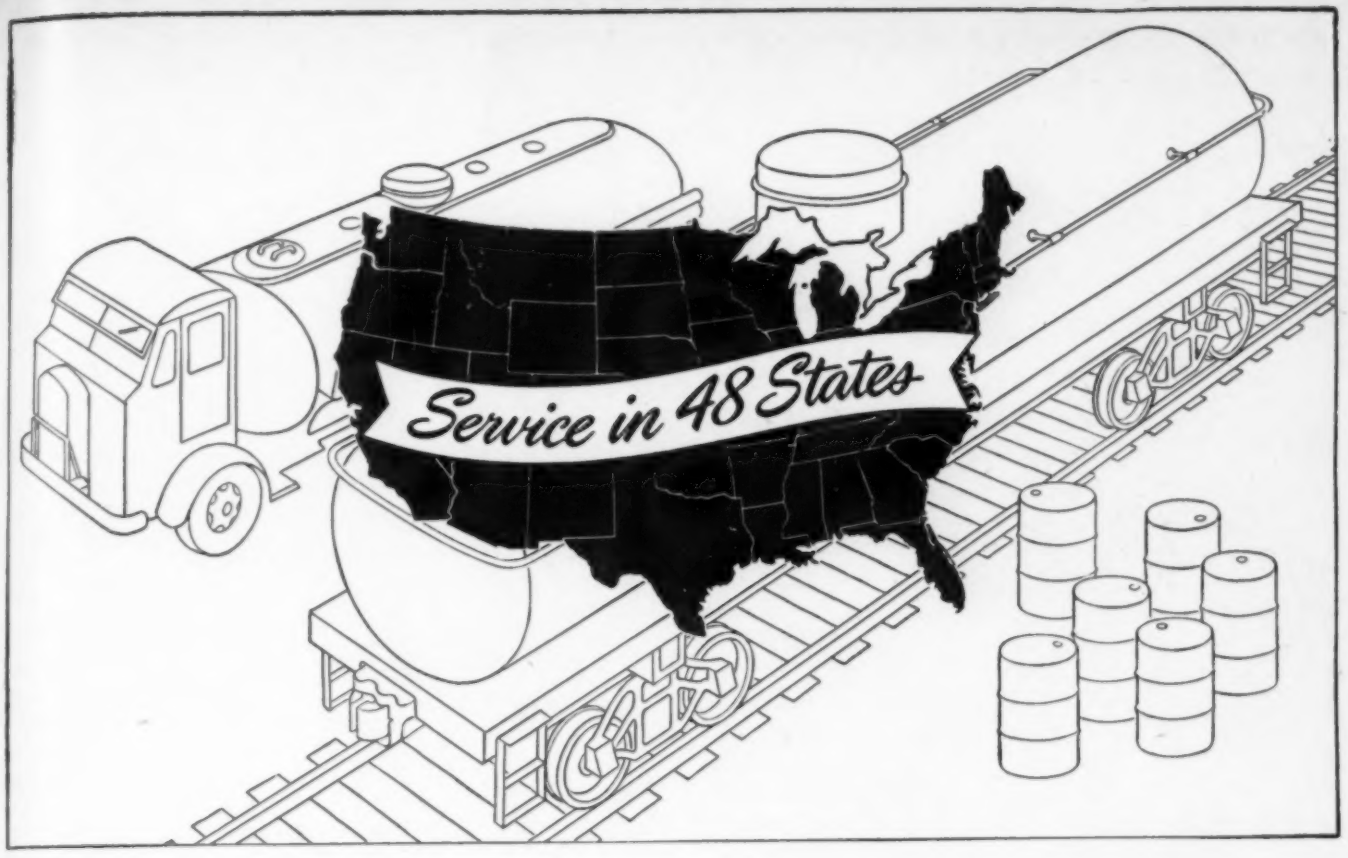
Metal-Cutting—a New Unit Process

DURING a study of the basic mechanism of cutting-fluid action, it was found that certain organic reagents when used as cutting fluids react vigorously with the metal cut even though these same chemicals were relatively inert to the uncut metal in bulk.

This discovery suggested the possibility of using a metal-cutting process to carry out reactions between metals and liquid or gaseous reactants. Subsequent tests showed that a metal-cutting process could be used to advantage in starting and controlling certain reactions involving metals. In several cases the metal was consumed as rapidly as it was cut. Such an application of a metal-cutting process is obviously far different from its generally accepted objective of producing finished machine parts.

Objective of the new process is to produce a chemical rather than a physical product. Even though the end products of these two applications of the metal-cutting process are so different, they both use a cutting tool to accomplish the desired end result.

Metal involved in the preparation is cut in the presence of the other reactants, thus utilizing the high tem-



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Ampco Metal makes the difference. The pumps are of the heavy-duty industrial type. They are soundly designed for mechanical durability, high efficiency, and ease of servicing. The paramount feature, however, is the material used in their construction; namely, *all aluminum bronze* as produced in Ampco Metal's laboratory-controlled foundry. These time-proven aluminum bronzes make possible the pumping of such liquids as sulphuric acid, acetic acid, mine water, brines, oils, solvents, beer, food process liquors, etc. Not only are the pump parts in immediate contact with the liquid made of aluminum bronze, but supporting members subject to seepage and spray, such as pedestal, shaft, and sleeve, also are made of this corrosion-resistant material.

Guaranteed efficiencies. These single stage, single suction, corrosion-resistant pumps use totally enclosed impellers. All liquid passages are streamlined for maximum efficiency, quiet operation, and minimum wear. Smooth sloping characteristics have sharp break-off to limit maximum horsepower requirements. All sizes of pumps are available either as pedestal-type for coupling connection to any type of drive, or close-coupled to a face-type motor.

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perature, high pressure, and highly stressed nascent surface produced at the point of cutting to start the reaction.

This new chemical technique which has been called mechanical activation promises to give many extremely versatile organometallic reactions a commercial significance which they have heretofore lacked because their application was limited to batch rather than continuous processes by the flammability and toxicity of the reactants and the difficulty of starting and controlling the reaction.

M. C. Shaw, Massachusetts Institute of Technology, before American Society of Mechanical Engineers, Atlantic City, Dec. 2, 1947.

Aromatic Chemicals From Petroleum

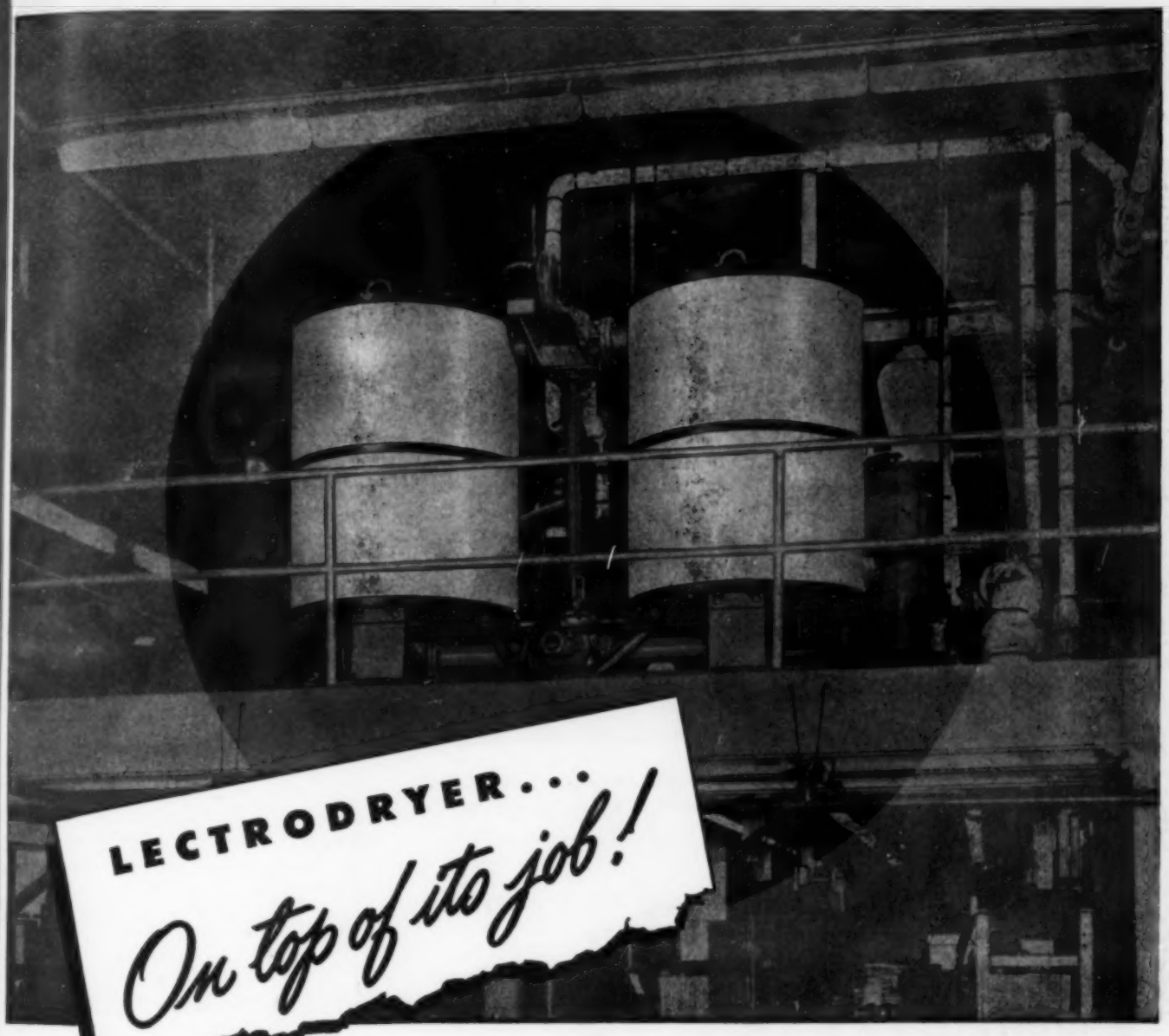
At the close of World War II, toluene demand dropped to a low level precisely as it did at the close of World War I and for exactly the same reasons. The postwar benzene picture is very different. The demand did not drop off sharply. Aviation gasoline demand ended with the war, but the normal demands which had been deferred in favor of wartime needs almost immediately took up the slack, and benzene has been in short supply from time to time since the war.

It is safe to predict that chemical uses for benzene will increase more rapidly than the increase, if any, in benzene production from existing sources. As this occurs over the coming years, price levels will be reached at which increasing quantities of benzene will be produced from petroleum. Such production will then tend to stabilize and limit prices since competitive units in the petroleum industry could produce many times more benzene than can conceivably be required.

Xylenes are already being produced from petroleum, representing a major part of the total supply. The isomeric xylenes have been offered in reasonably high purity. Ortho-xylene is now available in limited quantities from three sources and is being utilized in the manufacture of phthalic anhydride. In addition to phthalic anhydride the xylenes show promise for a number of other chemical syntheses.

Aromatic hydrocarbons higher than the xylenes have not so far been produced commercially by the petroleum industry in a high state of purity. Many of them are being produced in large quantities in crude mixtures and purification can be accomplished—given an adequate incentive.

Cresylic acids have for some years been produced from petroleum and are fully competitive with those from coal tar. However, the production



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from petroleum, like that from coal tar, has been of a byproduct type, and such production cannot be greatly expanded, and in fact is dropping due to the substitution of catalytic for thermal cracking. Another important aromatic byproduct of petroleum refining, the sulphonates, are in short supply.

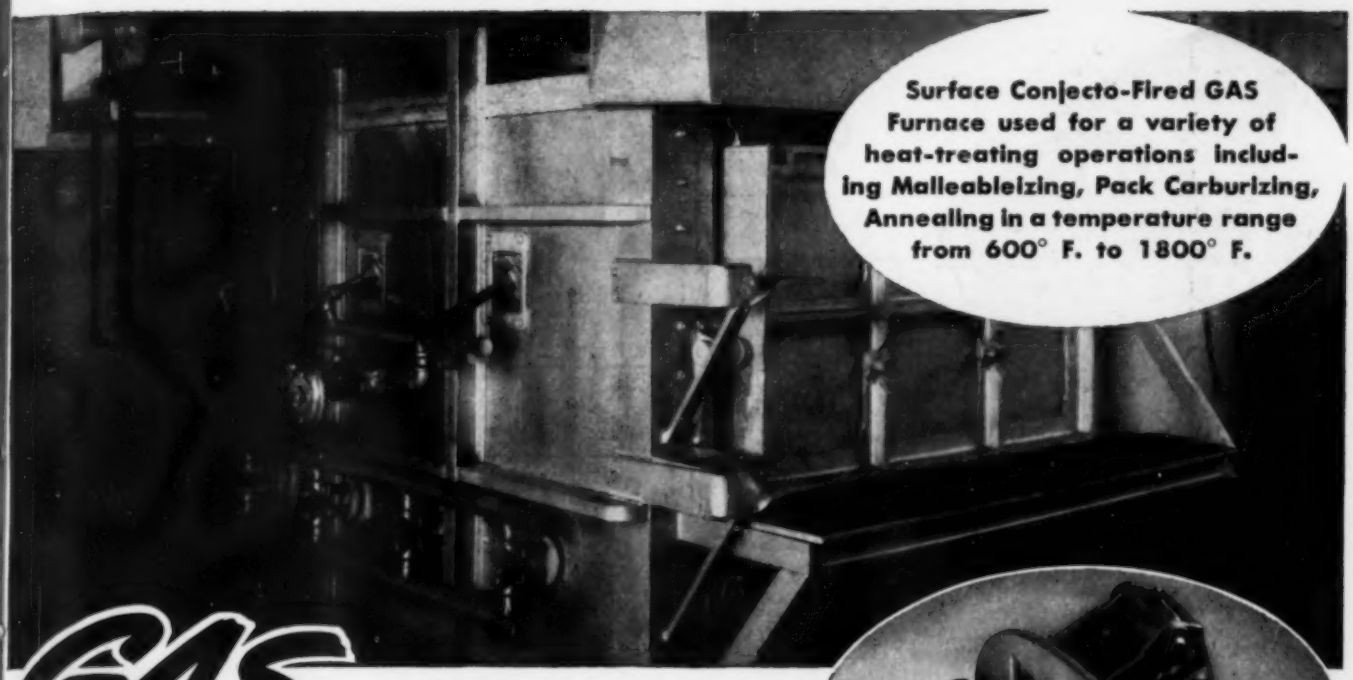
Due to the inherent limitation of such byproduct operations, the petroleum industry, following the lead of the chemical industry, has turned to synthetic methods. Thus byproduct sulphonates led to synthetic alkyl aryl sulphonates useful as detergents.

Synthetic organic detergents have long been made by a number of companies. They have been made from fats and oils in some instances and have utilized petroleum raw materials in other instances. As a generality, satisfactory detergents can be made from either source and cost is becoming the controlling consideration as to choice of raw material. The relative cost of materials from these two sources is markedly influenced by the historical and present-day fluctuations in the prices of fate and oils. It can, however, safely be said that petroleum-based synthetic detergents are, at present fat and oil price levels, markedly cheaper to make than those produced from fats. It is also safe to say, in my opinion, that petroleum-based synthetic detergents can retain this advantage at any probable level of fat and oil prices.

George L. Parkhurst, Oronite Chemical Co., before Pacific Industrial Conferences, San Francisco, Oct. 23, 1947.

Rubber Reclaim Studies

TODAY rubber reclaim is not considered a cheap substitute for crude rubber but it is a valuable compounding aid for both natural and synthetic rubber. Although the production of reclaim has been carried out for more than half a century it still is based almost entirely on experience rather than on a knowledge of the basic reactions occurring during the reclaiming process. Today tires are the greatest volume of scrap rubber subjected to reclaiming. Thus necessity decreed that, while the proper replasticization of the rubber scrap must be considered the goal of the reclaiming process, defibring of the scrap had to be carried out at the same time if a useful product was to be obtained. Various defibring agents had been used for this purpose over a long period of time, such as alkali, metallic chlorides and acids. These defibring agents aided the hydrolysis and decomposition of the cellulosic materials at elevated temperatures. While they performed adequately for their purpose their effect



Surface Conjecto-Fired GAS Furnace used for a variety of heat-treating operations including Malleableizing, Pack Carburizing, Annealing in a temperature range from 600° F. to 1800° F.

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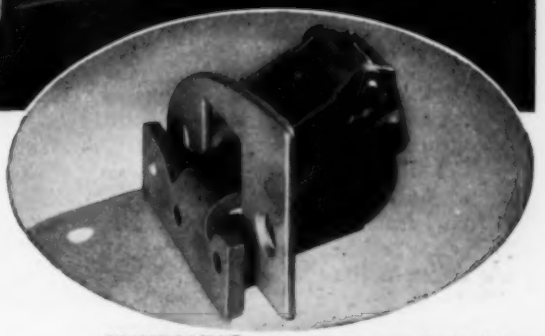
Experienced heat-treating specialists like Atwood Vacuum Machine Company use GAS because this flexible, controllable, rapid-heating fuel is so readily adaptable to all types of processing at any required temperature. If you haven't investigated modern heat-treating with GAS it's time to call your local Gas Company.



ANNEALING—Station wagon body hinge

Material:	SAE 1020
Temperature:	1600° F.
Time Cycle:	36 hours
Net charge:	6400 lbs.

PACK CARBURIZING—Brake Trunnions

Material:	Hot rolled SAE 1010
Temperature:	1650° F.
Time Cycle:	8 hours
Case:	.040
Net charge:	1500 lbs.

MALLEABLEIZING—Trailer Jack Screws

Material:	Malleable Iron
Temperature:	1750° F.
Time Cycle:	72 hours
Net charge:	10,000 lbs.

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on the rubber itself had not bee studied beyond the knowledge of pra tical differences encountered in the be havior of reclaims subjected to recla mation in the presence of any one o these defibring agents.

The large scale production of GR-S and the difficulties encountered in th reclaiming of mixtures of GR-S an natural rubber prompted a basic study of the reclaiming of these elastomer and an evaluation of the effect of tem perature, time, antioxidant and de fibring agents before any explanation of the function of reclaiming oil could be attempted.

Experimental reclamation of a well known vulcanized rubber compound was carried out in live steam (pot heater) and in suspension in water, al kali or metallic chloride solutions at 194 deg. C. in an autoclave. Because of the insolubility of reclaim the points of attack for such a study are rather limited. However measurements of the acetone and chloroform extracts as well as of the unsaturation of the re claim and its chloroform extract pro vide useful information in regard to oxidation and molecular breakdown of the polymer, particularly if these measurements are carried out as a func tion of the time of reclaiming.

While the experiments carried out in water and metallic chloride solution showed closely identical results the experiments in live steam and alkali solution indicated greater oxidation of the scrap and at the same time also greater molecular breakdown. In all cases however the oxidation of the reclaim was very small. The presence of antioxidant retards both processes. Thus the influence of the reclaiming environment was clearly established.

Inasmuch as sulphur combined dur ing the vulcanization of the original rubber article is not removed during the reclaiming process the increased plasticity and chloroform solubility of the reclaim can be expected to be due to a breakdown of the polymer chain. Previous experiments have shown such breakdown to occur during the milling of crude natural rubber and also dur ing its exposure to higher temperatures in the event that traces of oxygen are present.

Hydroperoxidic reactions, following a chain radical mechanism, had been found to account for this behavior. These reactions proved to be highly influenced by the alkalinity or acidity of the medium in which they were car ried out.

The hydroperoxides were found to be unstable compounds, little if any oxygen being permanently introduced into the polymer chains. It was also found previously that vulcanized rub ber could be reclaimed by milling at high temperature if traces of oxygen

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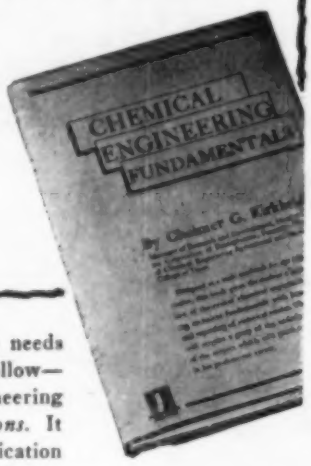

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were present. Such peroxidic reactions can however also be initiated thermally. The small amount of oxidation encountered during steam reclaiming and the definite influence which the alkali or metallic chloride solutions exerted on the course of the reclaiming reactions as well as the recovery of the reclaim—which has its counterpart in the recovery of crude natural rubber after milling—can be explained on the basis of the occurrence of hydroperoxidic reactions during reclaiming. Whether or not these reactions are influenced by the reclaiming oils usually added will depend on the latter's character.

Inasmuch as the reactivity at the carbon-carbon double bond is highly influenced by the presence and kind of substituent groups attached to it it can be expected that the rate of these reactions will be different for GR-S scrap. This would at least in part explain the difficulties encountered in the reclaiming of mixtures of GR-S and natural rubber scrap. It is expected that a better knowledge of the basic reactions occurring during the reclaiming process will aid in the problems encountered in the production of reclaim.

D. S. le Beau, Midwest Rubber Reclaiming Co., before Rubber Division, American Chemical Society, New York, Sept. 19, 1947.

How to Form a Corporate Patent Policy

BY CORPORATE patent policy is meant the way in which a corporation looks at the patent system and what it wants to make it do for it. It does not mean the day-to-day detail, no matter how much it takes up the time of research directors, of patent prosecution, or even the delicate art of politely telling patent examiners that they are mistaken. It does not mean the administrative technique of seeing to it that inventions are taken over by the patent department from your laboratory benches as soon and as thoroughly as possible. It does not mean the selection or training of personnel to deal with patent matters. Nor does it mean the forms of agreement which our companies are going to enter into among themselves. It involves all of these items and more, but it means the general philosophy of our patent actions. It means the "why" rather than the "how" and "what."

Patent policy should be formed by a company-wide committee, and must be based on and closely related to a company's major fields of interest and actual product direction. The research director should take part in its formulation on a basis of equality,—no more and no less. A sound patent policy is

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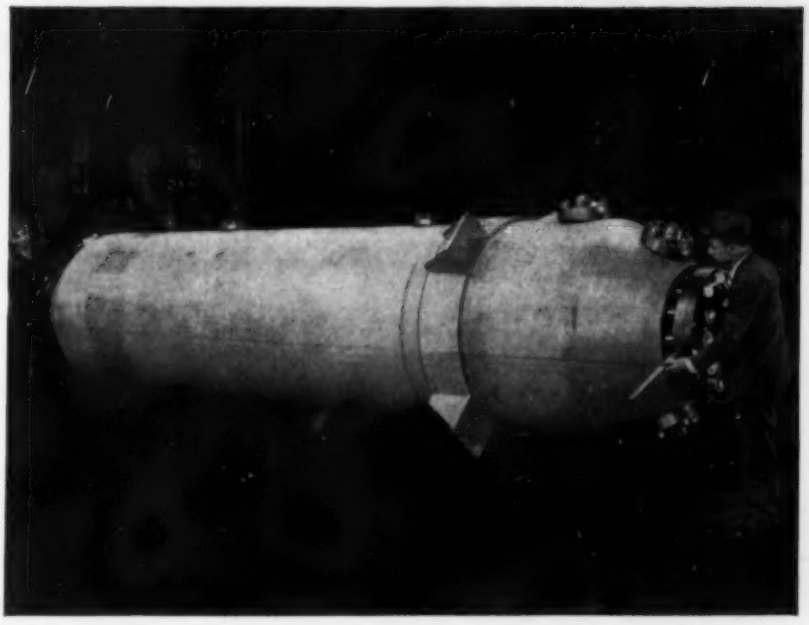
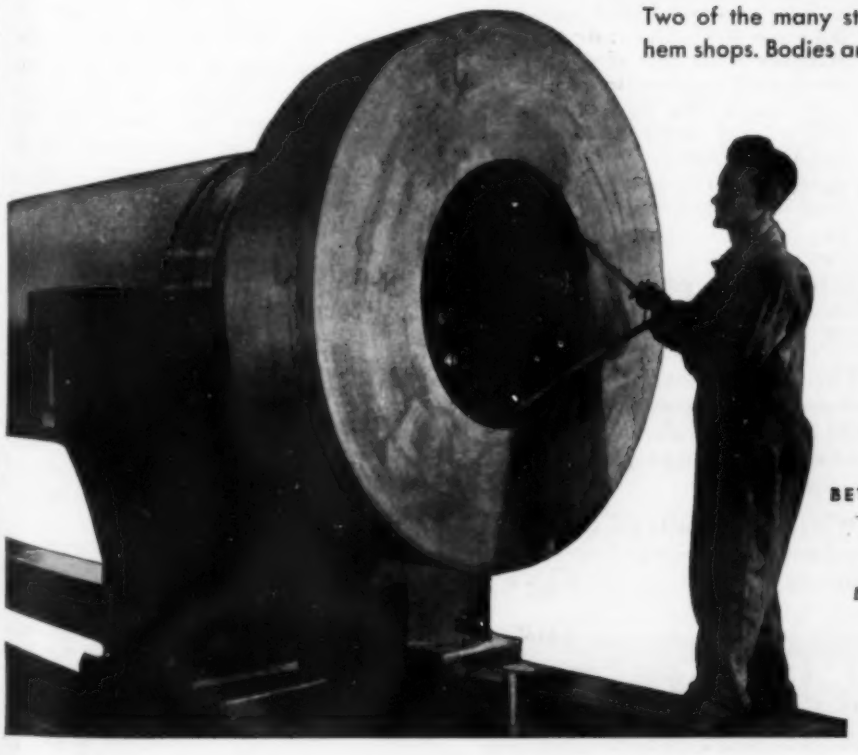


Two of the many steel pressure vessels produced at the Bethlehem shops. Bodies are seamless hollow forgings, sturdy and strong.



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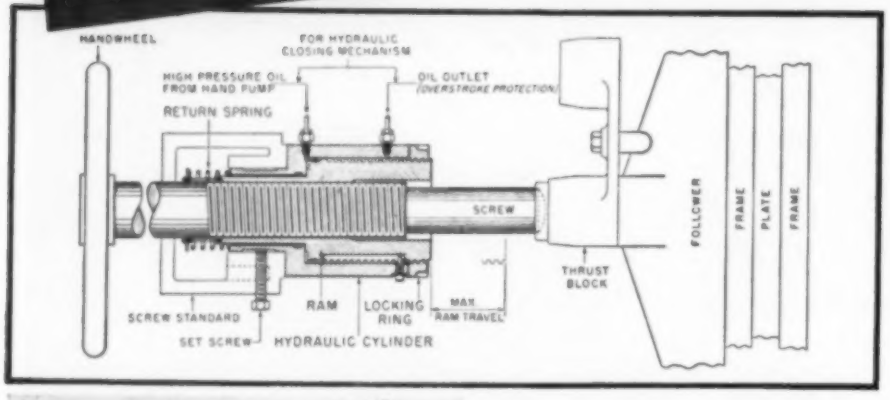

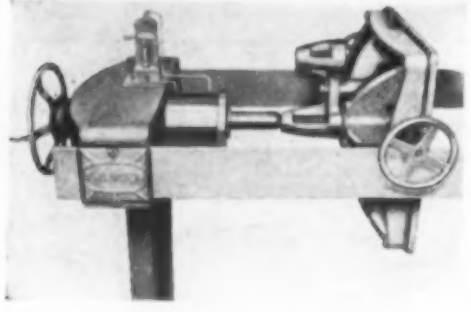

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The completely self-contained Hydro-Kloser fits the Shriver screw standard, replacing the thrust obtained by the manual movement of the screw with the straight thrust of the hydraulic ram. A few easy strokes of the hand pump close the filter press tight to required gauge pressure. A locking nut turned back on the ram keeps it tight. To open the press, the locking nut is released and hydraulic pressure is then released by opening the pump valve.

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marked by limitations, it will not attempt to serve as an instrument of unfair acquisitiveness, or of legal maneuvering to secure results contrary to the genuine non-political public interest. It should be applied by the same committee, and its application should be made an opportunity for the training of second-line department heads. It should be carried down into the ranks of research workers, without over-emphasis. It should be adhered to, just as a price policy or a standards policy. Above all, the soundest patent policy is no substitute for good research, all it should seek to do is to protect its results.

Albert S. Davis Jr., Research Corp., before Industrial Research Institute, Niagara Falls, Ontario, Sept. 25, 1947.

Petroleum Reserves vs. Petroleum Consumption

THERE are two basic reasons for shortages of petroleum in the United States at the present time, aside from securing the steel necessary for added refining facilities. One is the low rate of discovery. Exploration after 1938 has provided only half of the oil we have been using. This has not been due to a low rate of exploration, for during 1946 and the early part of 1947, 3 or 4 times as much work has gone into exploration as before the war. The lack of oil is due to increasing difficulty in finding oil.

Second important factor is the sharp rise in the demand for oil. At the present time 90 percent of the locomotives on order are oil-burning diesel motors. Figures for oil, prepared for home heating, are at the highest rate in history. The automobiles now in use are consuming more oil per car than before the war. Farms and farm machinery are demanding more and more oil, and in addition we have a growing aviation industry needing larger quantities of high-octane gasoline.

All of this has resulted in the need for oil of 4 million barrels a day before the war to 5 million barrels a day during the war, and to 5½ a day at the present time. It is predicted that before 1951 the demand will reach 6 million barrels of oil. It is not possible to supply such demand from our present petroleum reserves, and there is no promise that the reserves can be increased sufficiently by further exploration.

Many people believe that the United States can meet its increasing demand by importing oil particularly from the Persian Gulf Area. It is undoubtedly true that this region has a huge supply of oil of known reserves, and its potential supplies are enormous. Assuming, however, that these

now available

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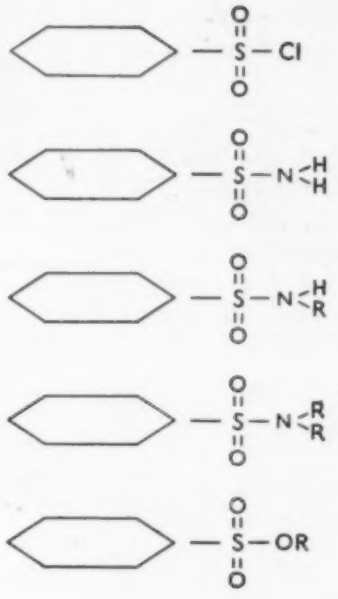
Address inquiries for samples and information concerning the properties and uses of these products to the Development Department. Our technical staff stands ready to aid you.



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Ethyl Benzenesulfonate
n-Propyl Benzenesulfonate
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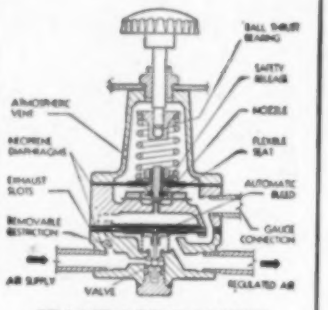
This announcement follows, within a few months, reductions in the list prices of Moore Valve Positioners, Moore Constant-differential Relays (for purge systems), and NULLMATIC Pressure Transmitters (for liquid-level and pressure measurement). In all cases, these new lower prices have resulted from increased production and tooling improvements.



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are developed as rapidly as possible, it is doubtful we have any material amount of oil that can be made available from this source for use in the United States before 1951. The construction of pipelines in the development fields, and all the necessary facilities require considerable time. At the same time, it is anybody's guess as to how much of this oil will be available after 1951.

If crude oil supplies fail to match the demand in this country, the question is not can we find other sources of oil, but rather what sources should be used. Secondary recovery methods are being developed for securing oil from sand, heretofore considered to be pumped out. Drilling for oil on the continental shelf, well out to sea has become a reality in the past few years. Tar sands offer further sources for oil.

In addition methods have been developed for the conversion of natural gas to good motor gasoline. Oil shale offers a source for petroleum with reserves entered to about four times our known crude oil reserves. However, the really vast source of raw material for oil is coal. The United States is thought to possess 50 percent of the considered supply, and the methods are available for converting this to produce liquid fuels from the highest octane gasoline through excellent diesel fuels to oils. If coal is used to supply the amounts needed for all combustion and heating problems, the reserves will be sufficient to last for hundreds of years.

It must be realized, however, that to supply the synthetic fuel industry is a large and complicated job. To produce 2 million barrels of oil a day from synthetic sources may require an investment of 8 or 9 million and also perhaps 15 million tons of steel.

W. C. Schroeder, U. S. Bureau of Mines, before American Institute of Chemical Engineers, Detroit, Nov. 13 1947.

New Technique Removes Fischer-Tropsch Heat

CHEAPER gasoline from coal is promised by new manufacturing processes. The Fischer-Tropsch synthesis and related processes that supplied Germany with much of her wartime gasoline, oil, and alcohol have been adapted and improved by American scientists and engineers.

The synthesis of liquid fuels consists of combining a mixture of hydrogen and carbon monoxide gases, which are made to react by heat, catalysts, and sometimes increased pressure. Several companies in the United States have done development work on a process utilizing the fluidized powder

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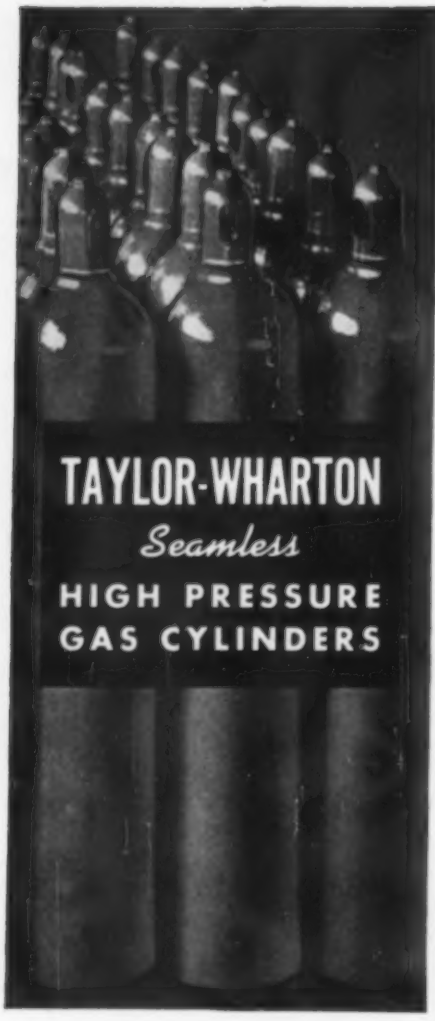

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technique, in which the catalyst is ground to a fine powder and suspended as a cloud in the swirling gases. A manufacturing plant of this type with a capacity output of 8,000 bbl. per day has been designed and is to be erected at Brownsville, Tex. This plant will utilize natural gas to make the required mixture of hydrogen and carbon monoxide. Pilot plant tests have shown that such a plant may operate continuously for as long as 1,600 hr., and will produce chiefly gasoline with minor amounts of diesel engine fuel and chemicals. The gasoline requires only a little refining to convert it to a suitable 75-octane motor fuel.

During the past two years the Bureau of Mines has developed another process, which employs a new technique for removing the tremendous heat that is generated. An oil is introduced into the converter along with the gas mixture. As the oil touches the hot surfaces it evaporates and absorbs heat. This technique permits elimination of bulky and expensive cooling equipment, and at the same time affords excellent heat control. When this method is used the catalyst is spread in pellets in a fixed bed. Compared with the fluidized powder technique, the oil-cooled process at its present stage of development has two major disadvantages: the fluidized powder process is 50 percent faster and requires about 25 percent less steel for installation. The efficiency of the oil-cooled converter may be improved, however, by further experiments which are now under way. The technique is inherently versatile. Slight alterations in catalyst, heat, and pressure result in widely different products, and the process can be used to make diesel oil, wax, alcohols, and other chemicals as well as gasoline.

H. H. Storch, U. S. Bureau of Mines, before Philadelphia Section, American Chemical Society, October 1947.

FOREIGN LITERATURE ABSTRACTS

Sodium Sulphate Deposits In Soviet Russia

GEOLOGICAL investigations made in recent years show that there are sufficiently large and numerous sulphate deposits in the USSR territory to supply both local industry and that of the entire Soviet Union. In order to supply the postwar demand for sulphate, there must be maximum utilization of all deposits and a sharp increase in the output of sulphate in existing units with a minimum expenditure of

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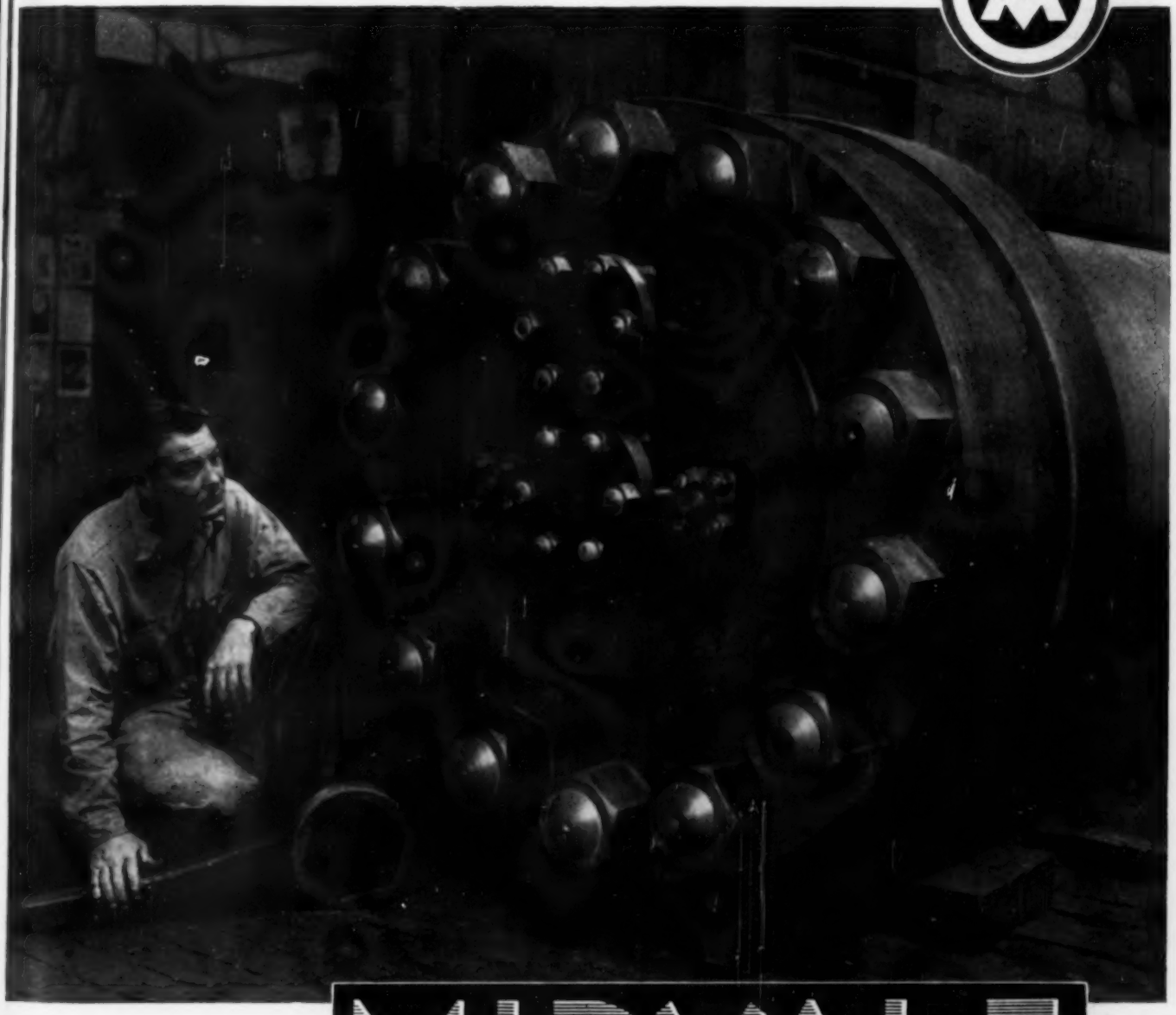

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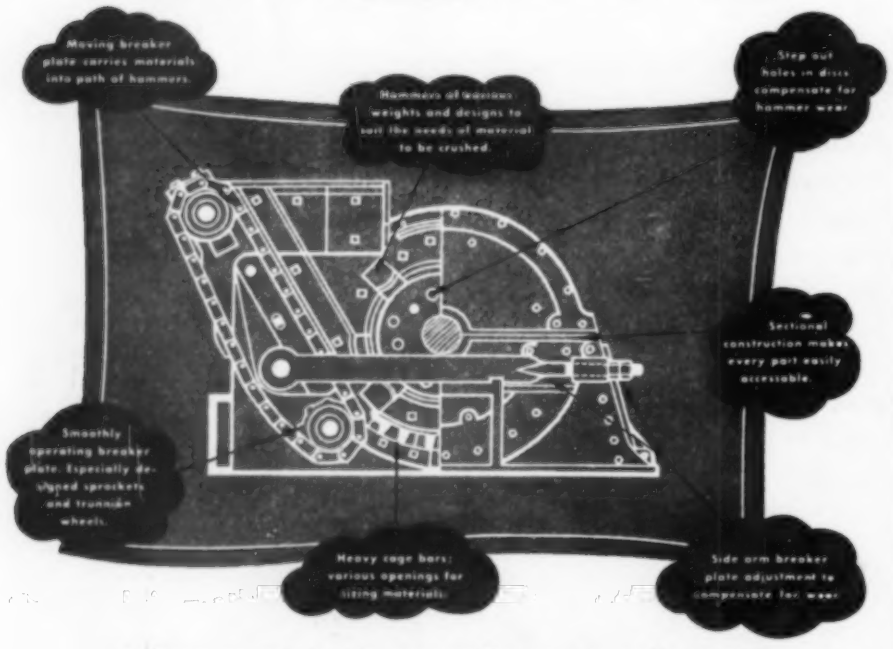
Moving breaker plate carries materials into path of hammers.
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capital and time. Every effort will have to be made to reduce railroad transportation of the salt by having the consuming industry located as near as possible to the source of this raw material. There are two types of sulphate deposits, the thenardite-mirabilite deposits of past geological epochs occurring at varying depths under a layer of sedimentary rock (in Central Asia); and the lake deposits which are precipitated out of lake brines annually in the form of mirabilite or thenardite. This latter type of deposit is particularly suitable for industrial exploitation. The postwar reconstruction period of the Soviet Union will require a sharp increase in the consumption of sodium sulphate in the glass industry, first of all, and also in the paper, nitrogen fertilizer industries and others. Development of the local sulphate industry and planning of prospecting and exploitation are therefore very important State problems at present.

Digest from "Current Tasks of Exploitation of Sodium Sulphate Deposits in the Fourth Five-Year Plan" by A. I. Dzens-Litovsky, *Khimicheskaya Promyshlennost*, No. 6, 157-159, 1947. (Published in Russia.)

Synthetic Aluminosilicate Catalysts

ONLY difference between catalysts obtained by splitting off sols and standard catalyst is in their hardness. It has been found that various metallosilicate catalysts can be prepared. On the basis of data published by P. Sabatier and N. D. Zelinsky, analogy is shown between the mechanisms of contact-catalytic transformations taking place in the presence of sulphuric and phosphoric acids, aluminum chloride and various oxides on the one hand, and the metallosilicate catalysts on the other hand. In studying the nature of catalysts it was found that application should be made of the method of complex investigation of the problem, using generalizations and comparisons with the data of the allied branches of science. The author suggests that certificates for catalysts should be introduced and he shows the possibility of predetermining the course of the catalytic processes for a given catalyst.

Digest from "On the Nature of Synthetic Aluminosilicate Catalysts and on the Mechanism of Contact-Catalytic Transformations in the Presence of these Catalysts" by A. N. Titova, *Zhurnal Obshchei Khimii* XVII, 673-680, 1947. (Published in Russia.)

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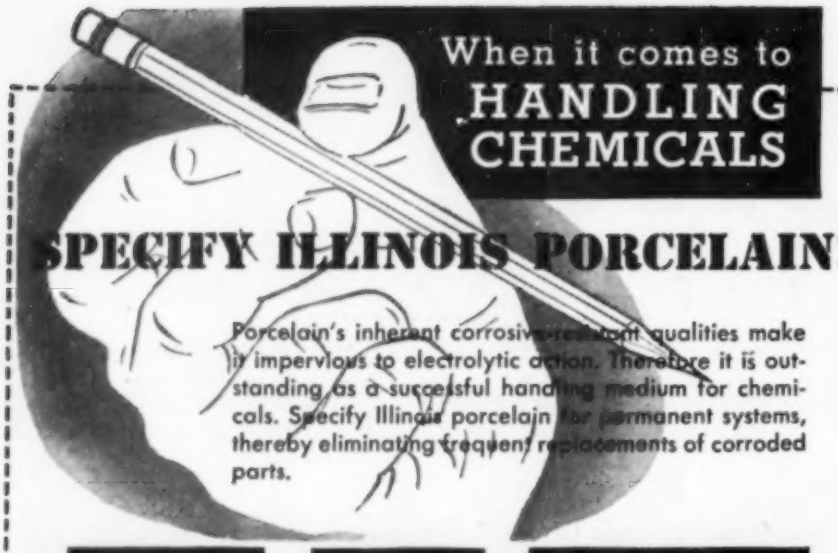

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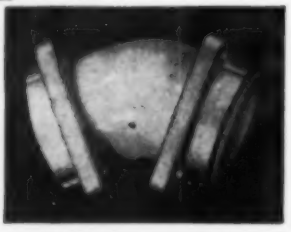

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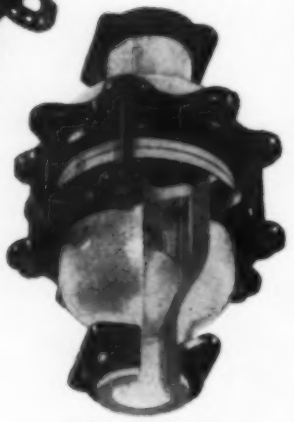
Each Illinois valve has a very carefully ground and lapped valve seat which will hold chemicals at high pressures. Every valve is routine tested at 100 pounds pressure for a minimum of one hour to assure a perfect valve seat. Note that valve seat is located in lowest possible position to insure uninterrupted flow of material when stem is in open position. Packing is acid-resisting asbestos — graphite impregnated.



CHECK VALVES
Both vertical and angle check valves are porcelain to porcelain with no metal in contact with material being handled. Friction loss extremely low because ample space provided for flow around ball. Valve seat ground and polished to very close tolerances — ball is a polished sphere.

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etc. There are more than 400 patented products on the market which use one or another form of bentonite in their preparation. More than 5,000 tons of bentonite are extracted in Argentina and most of this has been used in the preparation of groutings for oil wells. A small quantity, probably not much more than 5 percent, has been used to clarify wines, to make foundry molds and in the preparation of paints, enamels and cosmetics. From an economic point of view, bentonite is one of the important minerals used in Argentine industry. In most cases, bentonite has been used in the home industry in the form in which it appears on extraction from the pits. At most, it has been pulverized to produce a satisfactory product. The establishment of a new industry —the preparation of bentonite as done by various North American laboratories, would give the country a promising source of resources. Some of the bentonite deposits in Argentina could be exploited to better advantage. Some of the bentonites could be combined to produce a better product. The bentonite of Cuyo, for example, has high colloidal properties but a large sand residue. That of Patagonia, on the other hand, has reduced colloidal properties and a small sand residue.

Digest from "Contribution to the Knowledge of Argentine Bentonites" by A. F. Bordas, *Industria Minera* VI. No. 72, 51-55, 1947. (Published in Argentina.)

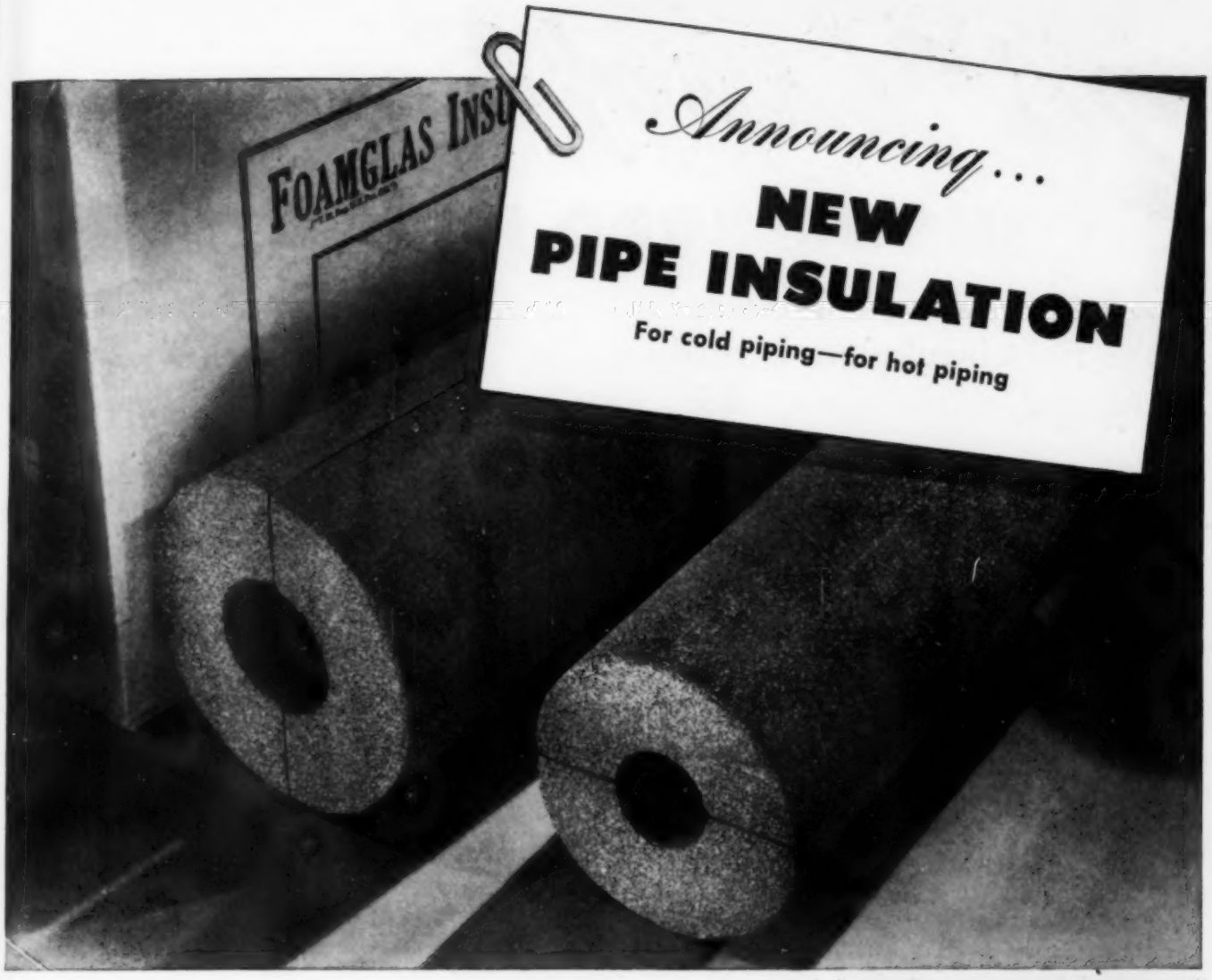
Colombian Petroleum

COLOMBIA holds ninth place among the world's producers of petroleum and second place among the countries of South America. The attached table shows the quantity of petroleum produced from 1921 through 1945. Of the 371,567,129 bbl. produced through 1945, 323,634,829 was exported and was valued at $369,620,343. The low figures for 1942 and 1943 are due to the difficulty of maritime transportation caused by the war. The Tropical Oil Co. and the Colombian Petroleum Co. have the chief concessions in commercial production.

Digest from "Notes on the Economic Geology of Colombia" by Jacques Delleur, *Dyna*, No. 57, 19-36 1947. (Published in Colombia.)

Petroleum Production in Colombia

Year	Crude Petroleum Produced, Bbl.	Percent of World Production	Accumulated Production
1921...	66,750	0.01	66,750
1924...	444,744	0.04	1,259,185
1927...	15,014,474	1.19	23,723,924
1930...	20,345,916	1.44	84,351,184
1933...	13,157,642	0.91	132,163,138
1936...	18,756,119	1.16	185,857,636
1939...	23,863,248	1.15	251,600,318
1942...	10,619,678	....	312,429,998
1945...	22,903,731	0.82	371,567,129



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Because it is a true glass PC Foamglas is unaffected by humidity, is highly resistant to fumes, vapors, acid atmospheres and many elements encountered in process industries that cause other materials to lose their insulating efficiency. When installed according to our specifications for recommended applications, PC Foamglas retains its original insulating efficiency *permanently*.

PC Foamglas Pipe Insulation is waterproof and vaporproof. These properties eliminate the need for expensive vapor and weather protection, as well as the costs of maintenance and replacement. It is strong, rigid, light in weight, easy to cut and fit with ordinary tools, right on the job.

Our engineering and research departments will be glad to consult with you on your special problems. Meanwhile, why not send the coupon for our new folder which gives full information on PC Foamglas Pipe Insulation? Pittsburgh Corning Corporation also makes PC Glass Blocks.

When you insulate with FOAMGLAS... you insulate for good!

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FOR ADDITIONAL INFORMATION SEE OUR INSERTS IN SWEET'S CATALOGS.

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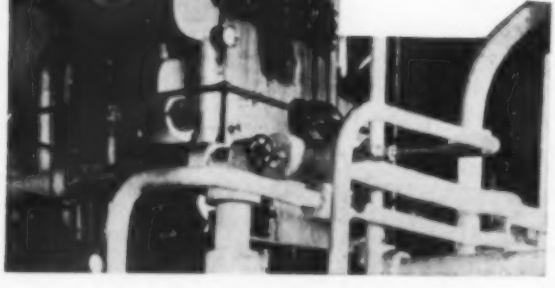
Another example proving... the right insulation correctly applied, never grows old.

ENGINEERING: The first step in an insulation job that will give years of service, such as the Railroad installation described below, is to call in an experienced insulation engineer. Johns-Manville maintains a staff of insulation experts. Each man knows how to take the guesswork out of your job...make it "*right* the *first* time."

RIGHT INSULATION: Many types of insulations are necessary to meet varied service conditions. In the Johns-Manville Research Laboratory—largest of its kind in the world—new and more efficient insulations have been developed. J-M Insulation Specialists help you choose the *right* insulation for each temperature requirement—from minus 400° up to 2800° F.

CORRECT APPLICATION: No insulation is better than the man who installs it. J-M Insulation Application Units are industry's first choice for completely efficient jobs because (1) Each Unit is trained in all phases of insulation application; (2) Only skilled mechanics and up-to-date application methods are used. You get thorough, dependable and speedy workmanship.



24 YEARS YOUNG! Johns-Manville Insulations were installed in this power plant of the Missouri, Kansas, Texas Rail Road Company at Parsons, Kansas, back in 1923. Because this job was *engineered right* and *applied right,* it is still providing dependable insulation service. For help on your insulation problems, write Johns-Manville, Box 290, New York 16, N. Y.

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CHEMICAL ENGINEER'S BOOKSHELF

Lester B. Pope, ASSISTANT EDITOR

First of Ten

ENCYCLOPEDIA OF CHEMICAL TECHNOLOGY. *Vol. I. Edited by R. E. Kirk and D. F. Othmer. Interscience Encyclopedia, New York. 982 pages. $20.*

Reviewed by L. B. Pope

APPEARANCE of the first volume of a projected 10-volume set indicates that Drs. Kirk and Othmer are well along in their stupendous task of producing a "specialized encyclopedia" on the "entire field of chemical technology for professional chemists and chemical engineers." The standard which "A to Anthrimides" sets is high, but subsequent volumes (promised at a rate of two or three a year) will undoubtedly continue to exhibit comparable quality.

An encyclopedia is not a dictionary. In an encyclopedia information may be classified, brought together and correlated. A unit operation, unit process or an entire industry can be described quite fully; several materials can be discussed under a single heading. Five elements, for example, are included under alkali metals; there will be a separate heading for the sodium compounds; and soda ash and caustic form a major part of the alkali and chlorine industries entry. Looking for data on chemicals, the user will find—in addition to synonyms, formulas, physical constants, uses and derivatives—information on topics such as history, reactions, production methods, production data, and materials of equipment construction. Other facts are included when available and necessary: government regulations in the case of industrial alcohol; cylinders for acetylene; cost of air conditioning. Illustrations and flowsheets serve to clarify important details.

Following an established precedent, the editors have obtained recognized authorities to author the various entries. The one on the alkali and chlorine industries by Deutsch is particularly comprehensive.

Printing, paper, binding and typography are excellent as they should be in a reference work. Price for the complete encyclopedia, necessarily, is too high for many private personal libraries. Industries, universities and research organizations, however, will find the complete 10-volume set indispensable. Individuals would do well to locate copies which may be consulted whenever necessity demands.

CO-EDITOR Kirk,, obviously with considerable pleasure, autographs the first copy of Volume I of their new encyclopedia for co-editor Othmer

Concise and Practical

NATIONAL PAINT DICTIONARY. *Third Edition. By Jeffrey R. Stewart. Published by Stewart Research Laboratory, Washington, D. C. 704 pages. $7.50.*

Reviewed by John R. Callaham

A GOOD technical dictionary (rare even in these latter-day technical times) has its own unanswerable excuse for being. Incomplete, sloppy and thrown-together compilations spring up like mushrooms, capitalize on the gullible market, quickly fade away. A good dictionary, on the other hand, is never "born," but is evolved slowly and painfully through hard and conscientious work over many years. The life and work of a lexicographer is not a happy one.

The purpose of Stewart's "National Paint Dictionary" (a member of the "good" breed) is to provide concise and practical information to manufacturers, distributors and industrial consumers of protective and decorative coatings; it is not intended to be an exhaustive scientific manual of encyclopedic nature. Terms included cover six categories: (1) industrial raw materials; (2) trade names of raw materials and finished products; (3) names of processes and methods; (4) terms denoting scientific instruments used primarily for evaluation purposes; (5) terms denoting quality, such as colors, textures and optical effects; (6) miscellaneous, including trade jargon.

For the paint technologist, as well as for other technical persons concerned or interested in the products of the paint and allied industries, fre-

RECENT BOOKS RECEIVED

Diary of Democracy. By H. A. Toulmin. Smith. $3.50.

Fundamentals of Chemical Process Calculations. By O. L. Kowalke. Macmillan. $2.80.

Industrial Applications of Infrared. By J. D. Hall. McGraw-Hill. $3.50.

Materials Handbook. 6th ed. By G. S. Brady. McGraw-Hill. $7.

Organic Chemistry. 3rd English edition. By P. Karrer. Elsevier. $8.50.

Organic Syntheses. Vol. 27. Ed. by R. L. Shriner. Wiley. $2.25.

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quent reference to this work should be helpful. A supplement contains useful charts, tables and statistics.

Science in World War II

COMBAT SCIENTISTS. *By Lincoln R. Thiesmeyer and John E. Burchard. Edited by Alan T. Waterman. Little, Brown & Co., Boston, in association with The Atlantic Monthly Press.* 421 pages. $5

Reviewed by H. C. Parmelee

WHEN the complete record is published of the cooperation of American scientists and engineers with the armed services in the late war, it will comprise a library of eight volumes detailing the history and activities of the Office of Scientific Research and Development. The book under consideration is the third of the series, seven of which are supplemental to "Scientists Against Time," the introductory volume that gave a summary of the development of improved weapons of warfare.

The current volume deals with the Office of Field Service of OSRD. As such it is mainly a story of personnel and organization developed to bring about the closest possible relationship between military authorities and civilian scientists and engineers. Hence it lacks some of the stirring drama of "Scientists Against Time," except to the extent that it takes the scientist out of the classroom and laboratory and puts him in the foxhole, the landing craft, the submarine, and the combat airplane. His function was to give expert advice to military forces in the field on the new weapons and devices developed by OSRD—radar, rockets, guided missiles, proximity fuses, etc. All told, nearly 300 scientists were assigned to overseas missions, two-thirds of them in Pacific areas. Many of the missions were dangerous, and some of the men were injured but none killed.

It is a tribute to the temperament of combat scientists, as well as to their technical knowledge, that they gained the acceptance and confidence of military authorities. Anyone who has brought a consultant into an industrial organization is familiar with the resistance encountered by an "outsider" who undertakes to give advice or introduce new ideas. Multiply this industrial situation many fold, and you get an idea of the problem of mixing civilian scientists with military leaders preoccupied with field operations. Fortunately the problem was recognized in advance, and a good selling job was done. General sales manager was none other than Dr. Karl T. Compton, eminent scientist and president of M.I.T., who headed the Office of Field Service. In the course of a 32-

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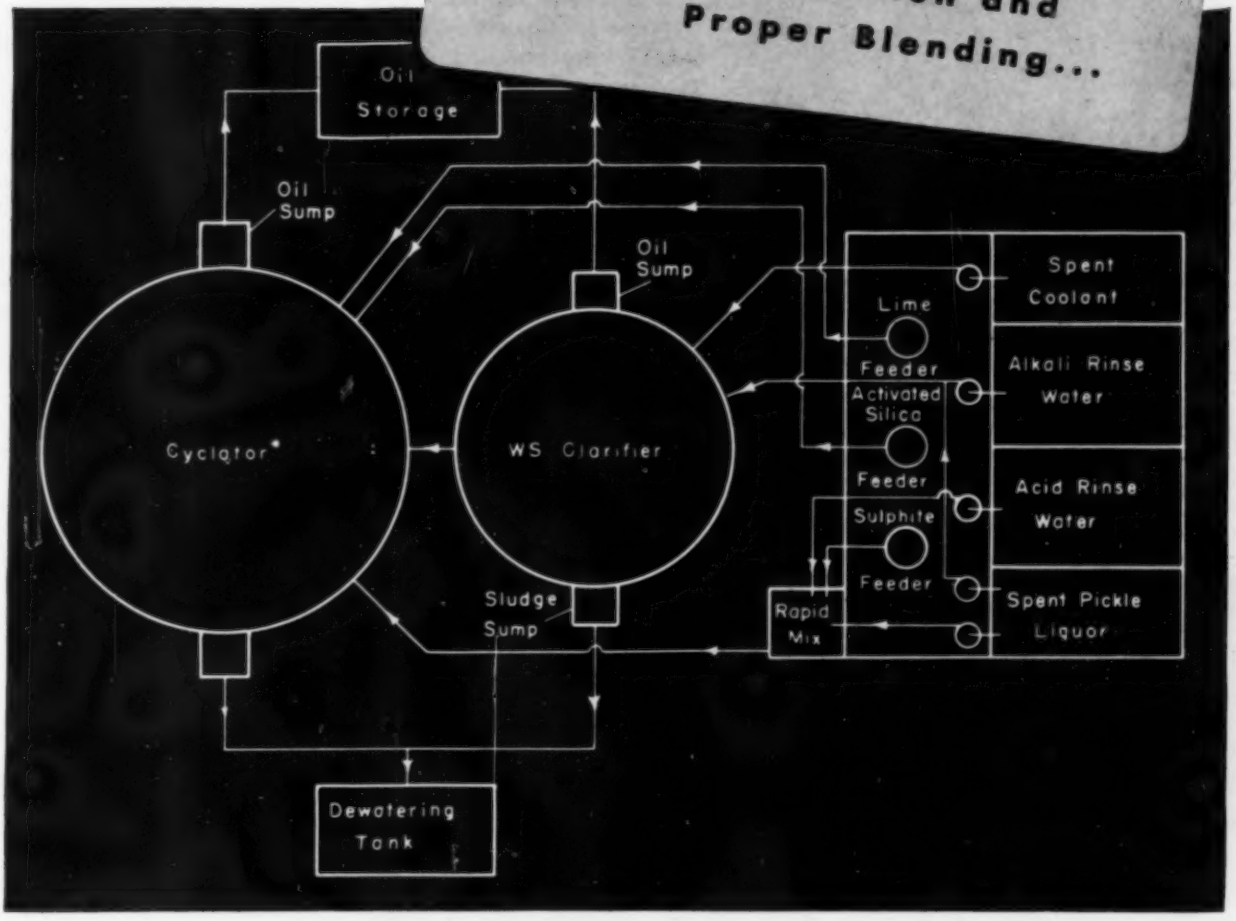

Pickling acid is normally a waste product, but its reducing action and coagulating properties are utilized in this INFILCO* plant for treating chromates and soluble oils, delivering effluent waste water free from oil or heavy metals, at very low cost for treatment.

This is an example of INFILCO "know how" in the handling of industrial wastes. Our experienced water and waste treatment engineers can probably assist you, too, in solving your water or waste problems.

When would you like to have one of our engineers call? INFILCO Inc., 325 W. 25th Place, Chicago 16, Illinois.

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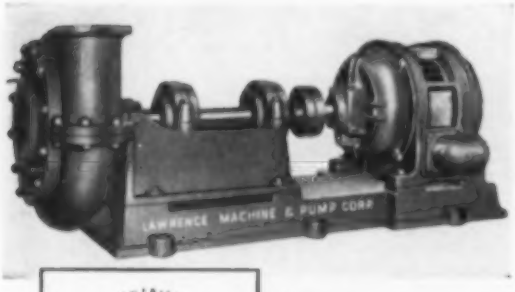
In this installation wear was unavoidable. To keep costs down wear had to be minimized, so Lawrence engineers designed a replaceable lining of extremely hard alloy. The impeller was made of the same material. The horizontally-split construction permits quick, easy removal of the lining and facilitates repairs and replacements. The net result is low cost pumping. This same method can be adapted to the handling of any highly abrasive sludge, slurry, or mixture. We'll be glad to discuss it with you — without obligation.



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day plane trip to Pacific theaters of war he dealt at top level with the Army and Navy, and developed a blueprint for the field service of OSRD. The Navy was the first to accept the services of OFS, but ultimately the Army was its largest customer. Of 87 projects of OFS the Army sponsored 55, and was joint sponsor with the Navy of ten more.

All kinds of scientists were engaged in the work of OFS. Mathematicians were in great demand for operations analysis and research. Biologists, geologists, chemists, physicists, engineers, and medical specialists dealt with a vast variety of problems, many of which were peculiar to tropical conditions in Pacific areas. They outwitted the enemy submarine and the kamikaze, and conquered malaria, jungle rot, and psychoneurosis. Specialists in time and motion study greatly simplified the clerical work of the Army, eliminating miles of travel and tons of red tape. Amphibian vehicles—DUKW's, Weasels, Water Buffaloes, and PENGUINS—were demonstrated and "sold" to the Army and Navy. Protection by camouflage was developed to a high degree, and infrared flashlights enabled our troops to stop enemy infiltration at night. Not the least important activity of combat scientists was to follow close on the heels of our advancing troops in Germany to get an over-all picture of enemy scientific research in war.

A special section of this book is devoted to problems of amphibious navigation—finding the beaches and destroying underwater obstacles to landing. Need for the former was demonstrated at Casablanca where our troops missed intended beaches by five miles; and the importance of the latter was shown at Tarawa where obstacles retarded the landing of troops and made them easy prey to enemy guns. Finding the beaches was solved by radar so that landing craft could reach shore within 50 yards of a predetermined position and within a minute of scheduled time. Demolition of underwater obstacles was studied intensively, but not satisfactorily solved.

Constants

HANDBOOK OF CHEMISTRY. *Sixth edition. Compiled and edited by N. A. Lange assisted by G. M. Forker with mathematical tables by R. S. Burington. Handbook Publishers, Sandusky, Ohio. 2,066 pages. $7.*

REVISION of this well known reference book has made it even more valuable to chemists. Three new sections have been added covering modern concepts of matter, values of the gas constant,

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IF dust, soot and smoke are a threat to the quality of your products, anything short of super-clean air will cost you money. That's why manufacturers who refuse to leave anything to chance choose the AAF Electro-Cell filter.

This modern electronic precipitator not only removes dust and soot from the air but also smoke and dust particles of fractional micron sizes. Where continuous operation is desired, filter can be supplied which provides for automatic cleaning of the collector plates without interruption of service. However, these collector plates are so designed that they may be removed for servicing in a special cleaning tank or washed and re-oiled in place by manual methods. Other features such as sectional construction and full height hinged ionizers make for simplified installation and greater safety.

Information on the Electro-Cell Electronic Precipitator is contained in Bulletin No. 252. It's free for the asking as are the services of AAF application engineers to aid you with your air filtering problems. Just call your local AAF representative or write direct to—

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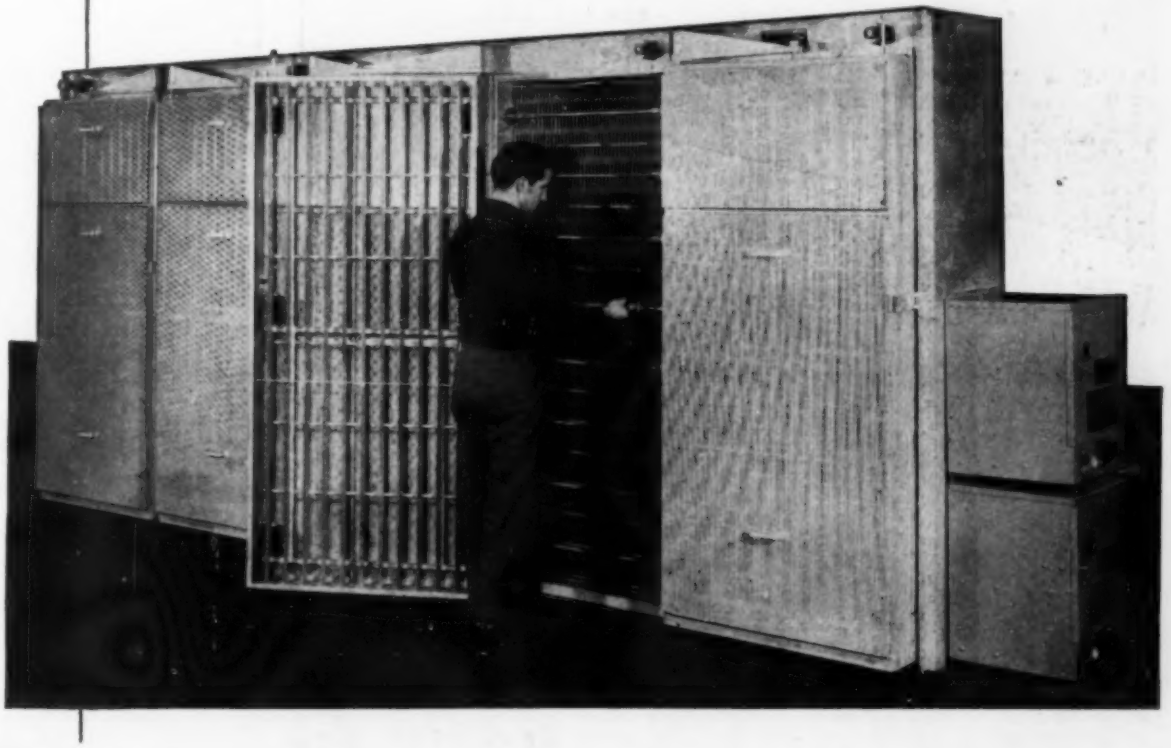

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and composition of sea water. Sections wherein extensions and revisions have been made include periodic arrangement of elements, ionization constants, critical constants, coefficients of expansion, heat and free energy of formation of compounds. The compiler has dropped engineering data on pipes, valves and fittings, also flow of water and gas in pipes.

Probably the section of greatest value is the table of physical constants of inorganic compounds. This has been completely reworked and corrected. Numerous changes may be noted as well as the addition of refractive indexes on many compounds.

All practicing chemists and chemical engineers need a handy reference giving data available for their use. Lange's remains one of the best.

Insight

ELEMENTARY NUCLEAR THEORY. *By H. A. Bethe. John Wiley & Sons, New York.* 147 *pages.* $2.50.

Reviewed by W. De Cew

FUNDAMENTALS of nuclear physics are introduced in this book at a level suitable for graduate students in physics or chemistry. Mastery of the topics covered should provide chemical engineers with a firm foundation for professional activity in the nuclear power field.

Nuclei and nuclear forces are treated in a quantitative and logical manner, yet the author succeeds in communicating a penetrative insight into the spirit and problems of contemporary nuclear science. Bethe also succeeds in providing ample evidence that the science of the rearrangement of nuclear particles, from the standpoint of heats or reaction and rates of reaction, is today as well developed as chemistry itself.

Production Guide

MANUAL ON FERTILIZER MANUFACTURE. *By Vincent Sauchelli. The Davison Chemical Corp., Baltimore 3, Md.* 126 *pages.* $4.

Reviewed by Russell S. McBride

THIS MANUAL has been prepared by the director of agricultural research of Davison Chemical Corp. with the purpose stated in the sub-title of the book itself: "Prepared for the instruction of candidates chosen for training in supervisory positions in fertilizer plants, and for the not too well technically trained who want to know more about fertilizer manufacturing procedures."

The book seems to be one that should be very valuable for this training of the cadets of a technical com-

Do you know the COLD FACTS about G-E Silicones?

Ever hear of an oil that will still pour even when the temperature drops to −120 F? At General Electric we're manufacturing such an oil. It is known as G-E silicone oil and it has some mighty interesting uses.

For example, manufacturers of stratoliners—high-altitude transports that speed through the extremely cold upper levels of air—will find General Electric silicone oil to be excellent for use in hydraulic systems. With silicone oil acting as the hydraulic fluid, plane builders can guard against the danger of "frozen" landing gear and wing flaps, despite subzero temperatures.

If you're interested in a gasket material which is remarkably resistant to extreme cold, we suggest you investigate General Electric silicone rubber. This unusual material retains its stability and elasticity at a thermometer reading as low as −70 F.

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WANT TO KNOW MORE ABOUT G-E SILICONES? There's more to know and there are many more uses for these amazing products. Why not drop us a line. Let us discuss your particular production problem with you. *Chemical Department, General Electric Company, Pittsfield, Massachusetts.*

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The Morehouse high speed principle makes these revolutionary mills possible. Advanced engineering design and nearly half a century of experience in manufacturing quality products contribute to smooth economical, dependable operation. Save money, save valuable space and improve both volume and quality with Morehouse HY-R-SPEED MILLS.

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MODEL SB 1400
for non-corrosive materials

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in stainless steel for corrosive materials also available.

Adjustable without stopping
Easy to clean or change over
No special training necessary
Replaceable parts
10 or 20 H.P. motor

(3000-3600 R.P.M., 50/60 cycle, 220/440 volt AC, 3-phase, special types on request.)

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pany. The author is correct when he says, "Much of the material may be 'old stuff' to some of our men", but this does not detract from the value of a training manual. Nor should it reduce the value for many who have only occasional interest in finding out in a general way how fertilizer is made and some of the broad principles of fertilizer application in agriculture.

There are so few good books on fertilizers that this item will be a real addition to the reference library shelf of many who have only occasional need for fertilizer information. Its simple straightforward presentation seems pedagogically good for the company student and very convenient for the occasional user.

RECENT BOOKS AND PAMPHLETS

Dimethyl Sulphate. Chemical Safety Data Sheet SD-19, published by the Manufacturing Chemists' Association, 608 Woodward Building, Washington 5, D. C. 14 pages. 20 cents. Manual discussing the safe handling and use of dimethyl sulphate.

Polymerization of Acetylene to Cyclooctatetraene. By Karl Kammermeyer. Published by the Hobart Publishing Co., Box 4127 Chevy Chase Br. Washington, D. C. 118 pages. $17.50. A "PB" Report, originally partly in German, now completely translated.

Surface Active Agent File. Research Advisory Corp., 17 South High St., Columbus 15, Ohio. 284 cards. $35. Coded file cards each containing chemical and physical data on a surface active agent.

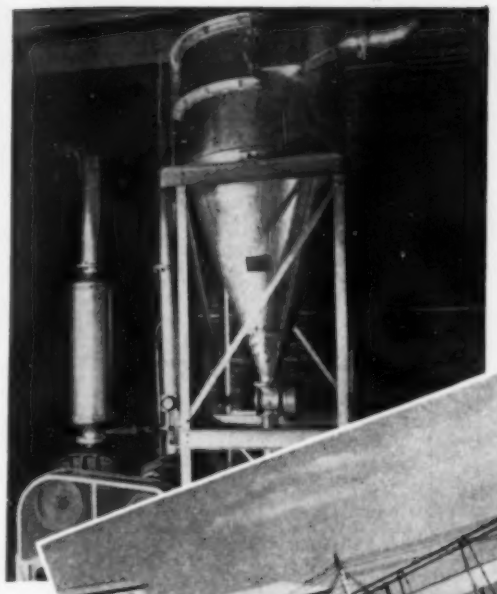
Flameproofing Textile Fabrics. Edited by Robert W. Little. ACS Monograph, published by the Reinhold Publishing Corp., 330 West 42nd St., New York. 410 pages. $6.75. Based on wartime researches in flameproofing military fabrics, mostly cotton and rayons. Covers types of retardents available, fundamental mechanisms by which they prevent flaming and glowing, how they are applied commercially and tested, and the applications which exist for them in military and civilian fabrics.

Bibliography and Abstracts on Electrical Contacts. 1946 Supplement. Technical Publication No. 56-C, published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 26 pages. 75 cents. Latest replacements and new references for 1940-1944 covering publications in 1945 and 1946.

Compounding Ingredients for Rubber. Second edition. By the editors of "India Rubber World." Published by the Bill Bros. Publishing Corp., 386 Fourth Ave., New York, N. Y. 640 pages. $5. The three parts of this book discuss dry rubber compounding materials, latex compounding ingredients, and raw materials.

Approved Equipment for Industrial Fire Protection. Published by the Associated Factory Mutual Fire Insurance Cos., 184 High St., Boston 10, Mass. 135 pages. $2. A listing of the names of manufacturers and the specific devices which have been tested and approved by the Factory Mutual Laboratories.

Application of Overfire Jets to Prevent Smoke from Stationary Plants. Technical Report No. VII. By Richard B. Endahl and William S. Major. Published by Bituminous Coal Research, Inc., Pittsburgh 22, Pa. 31 pages. 25 cents. Discussion of the design and use of



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Through the simplicity and flexibility of the Airveyor Systems installed, corn is conveyed from one building to another—from 34 dryer bins and 14 ear-sorter bins in one building; 20 dryer bins, 20 storage bins, 51 grading bins, and four basement vaults in another; and 16 dryer bins and 84 storage bins in still another . . . a total of 243 bins being served by the Airveyor Systems.

The Airveyor Systems are handling this hybrid seed corn with a minimum of breakage, a very essential requirement, due to the high market value of the product.

The adaptability and flexibility of the Airveyor System as applied in this plant, can very well be appreciated when compared with the many difficulties to be encountered through the use of mechanical equipment to accomplish the same results.

If you have a conveying problem, consult us. Conveying is our business . . . what we have done for others, we can do for you. Our engineering department is at your service.

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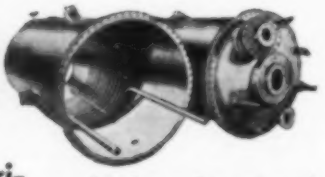

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Offers advanced fabrication techniques resulting from over half a century of progressive experience. Qualified as Specialists in metallurgical fabrication NOOTER makes available a background of technical knowledge of the properties and behavior of metals and alloys.

10" diameter x 26' long chemical tower made in five sections of pure copper. All welding was performed by the carbon arc method.

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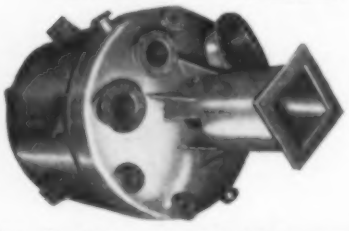

One of a battery of solid nickel processing tanks, 5' x 5', with steel agitator support on dished head.

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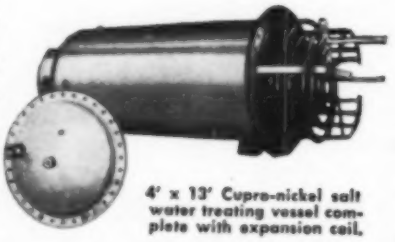
Include also an evaluation of NOOTER specialized services covering the many vital factors in plate work for strength and safety combined with resistance to corrosion and high temperatures.



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blower jets, steam-air jets and flue-gas jets.

An Introduction to Metallurgy. Second edition. By Joseph Newton. Published by John Wiley & Sons, 440 Fourth Ave., New York, N. Y. 518 pages. $5.50. An elementary treatment of metallurgy stressing principles rather than practices.

Protection for a Representative Industry (Aluminum). The Problem of Reducing Vulnerability to Atomic Bombs, Chapter IV. Published by Princeton University Press, Princeton, N. J. 37 pages. The author applies the principles set forth in his recent book on the social and economic problems of atomic energy to a specific industry, the aluminum industry.

Advances in Enzymology, Vol. VII. Edited by F. F. Nord. Published by Interscience Publishers, 215 Fourth Ave., New York 3, N. Y. 665 pages. $8.75. Twelve independent sections by various authors covering enzymes and related subjects of biochemistry.

Grundlagen der Eisengewinnung. By Robert Durrer. Published by A. Francke Ltd. Co., Berne, Switzerland. 210 pages. s.fr. 20. An introductory study of the metallurgy of iron. Contains 85 graphs and a table.

The Heat-Treatment of Steel. By Edwin Gregory and Eric N. Simons. Published by the Pitman Publishing Corp., 2 West 45th St., New York, N. Y. 358 pages. $4. Generously illustrated treatment of temperature measurement and control, pyrometers and thermocouples of various types, gas, electric and oil-fired furnaces, refractories and equipment and the principles and processes of heat-treatment and their application to steel production.

The Color Problem in Sucrose Manufacture. By F. W. Zerban. Technological Report Series No. 2, published by the Sugar Research Foundation, Inc., 52 Wall St., New York, N. Y. 31 pages. A report on non-enzymatic browning in the sucrose industry.

Non-Ferrous Production Metallurgy. By John L. Bray. Published by John Wiley & Sons, New York, N. Y. 587 pages. $6. Second edition of a textbook on production metallurgy.

Proceedings Third Annual Spring Meeting Metal Powder Association. Published by the Metal Powder Association, New York, N. Y. 70 pages. $2.50. Includes the four papers and five panel discussions presented at the meeting.

Rubber Red Book. 1947 edition. Published by the Rubber Age, 250 West 57th St., New York 19, N. Y. 835 pages. $5. Directory of the rubber industry listing rubber manufacturers in the United States and Canada, rubber machinery and equipment, chemicals and compounding materials, fabrics and textiles, etc. Includes also a who's who in the rubber industry.

1947 A. G. A. Industrial Gas School. Published by the American Gas Association, 420 Lexington Ave., New York, N. Y. $7.50. A complete set of the lectures delivered at the 1947 AGA Industrial Gas School, Columbus, Ohio.

The Work Book of Fundamental Organic Chemistry. By E. F. Degering. Published by University Lithoprinters, Ypsilanti, Mich. 265 pages. $1.75. An aid to be used in conjunction with a text in the teaching of introductory organic chemistry.

New Weapons for Air Warfare. By Joseph C. Boyce. Published by Little, Brown and Co., 34 Beacon St., Boston, Mass. 292 pages. $4. Description of the wartime work of the National Defense Research Committee on devices to control the behavior of shells, bombs, rockets and other missiles.

Literature Review on Corrosion of Metals and Materials by Flue Gas Condensate. By H. A. Pray, F. W. Fink and R. S. Peoples. Published by the Battelle Memorial Institute, Columbus 1, Ohio. 30 pages. Report No. 1 to the AGA Committee on Domestic Gas Research on a research project investigating corrosion, oxidation and deterioration of metals under the influence of products of gaseous fuels.

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Monobenzyl Ether of Hydroquinone

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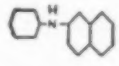
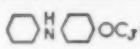
Monobenzyl ether of hydroquinone may be used as an antioxidant, stabilizer, or plasticizer in pharmaceuticals, paints, varnishes, and organic synthesis.

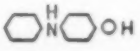
Dibenzyl ether of hydroquinone may be used as a high boiling solvent for perfumes, cosmetics, pharmaceuticals, plasticizers, paints, varnishes, and organic synthesis.

Other organic chemicals

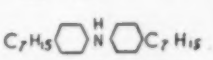
Secondary Aromatic Amines


Phenyl B-Naphthylamine

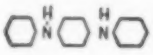

p-Isopropoxy Diphenylamine

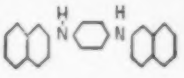

p-Hydroxy Diphenylamine

Mixed Mono and Diheptyl Diphenylamines

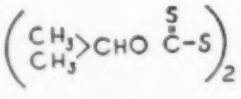


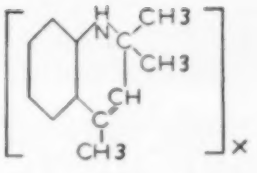
Di-secondary Aromatic Amines

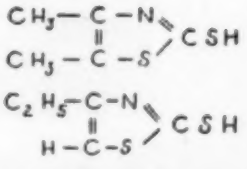

Diphenyl p-Phenylenediamine

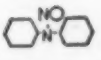

Di B-Naphthyl p-Phenylenediamine

Miscellaneous


Di-Isopropyl Dixanthogen


Trimethyl Dihydro Quinoline Polymer


Mixed Ethyl and Dimethyl Mercaptothiazoles


N-Nitroso Diphenylamine

All materials listed here are available in commercial quantities. Prices and technical information are available on request. Please write Dept. CD-2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

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GOVERNMENT PUBLICATIONS

The following recently issued documents are available at prices indicated from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. In ordering publications noted in this list always give complete title and the issuing office. Remittances should be made by postal money order, coupons, or check. Do not send postage stamps. When no price is indicated, pamphlet is free and should be ordered from the bureau responsible for its issue.

The Fertilizer Situation for 1947-48. Department of Agriculture. Unnumbered, processed. This is the statistical review of fertilizers and nitrogen, potash, and phosphate for fertilizer on which the Department of Agriculture bases its recommendations for Marshall Plan and relief actions.

Commercial Cotton-Bleaching Processes and Their Effect on Fabrics. By James H. Kettering and Rita M. Kraemer. Department of Agriculture, Technical Bulletin No. 941. Price 10 cents. Research report giving details of experimental studies at Southern Regional Lab.

The Small Rural Industry—A Study of the Possibility of Making Insulating Board From Straw. By E. C. Lathrop, et al. Department of Agriculture, Circular No. 762. Price 15 cents. A careful chemical engineering study with recommendations which show limitations on such projects.

Workers in Subjects Pertaining to Agriculture in Land-Grant Colleges and Experiment Stations, 1946-47. Department of Agriculture, Miscellaneous Publication No. 625. Price 25 cents. An excellent directory of research agencies including numerous chemurgic groups.

Higher Education for American Democracy. A report of the President's Commission on Higher Education submitted to the President at the year end and released between Christmas and February in six parts, as follows:

Volume I. Establishing the Goals. Price 40 cents.

Volume II. Equalizing and Expanding Individual Opportunity. Price 35 cents.

Volume III. Organizing Higher Education. Price 30 cents.

Volume IV. Staffing Higher Education.

Volume V. Financing Higher Education.

Volume VI. Resource Data. Prices for Vols. IV, V and VI have not been announced.

Second Annual Report to the President by Council of Economic Advisers. December 1947. Price 15 cents. This is the economic study of the Nourse committee, made under the law which requires semiannual recommendations on the economic condition of the nation.

Testing and Rating Convectors. National Bureau of Standards, Commercial Standard CS140-47. Price 10 cents. This recommended commercial standard relates primarily to household radiators. But the methods of testing and rating appear adaptable to many plant units of chemical engineering nature.

Training Films for Industry. By Floyde E. Brooker, et al. U. S. Office of Education, Bulletin 1946, No. 13. Price 30 cents. This is the final report on the war training program regarding the visual aids used in war training. Many of these are said to be applicable to industrial training also.

Statistical Abstract of the United States. Department of Commerce, unnumbered volume. Price $2.75. Buckram bound. This is one of the annual series which was interrupted during the war period. It includes many market-study reference tables but little, if any, new data. It is largely a compilation of statistics principally from government sources as previously issued on economic, social, and, to a limited extent, industrial and

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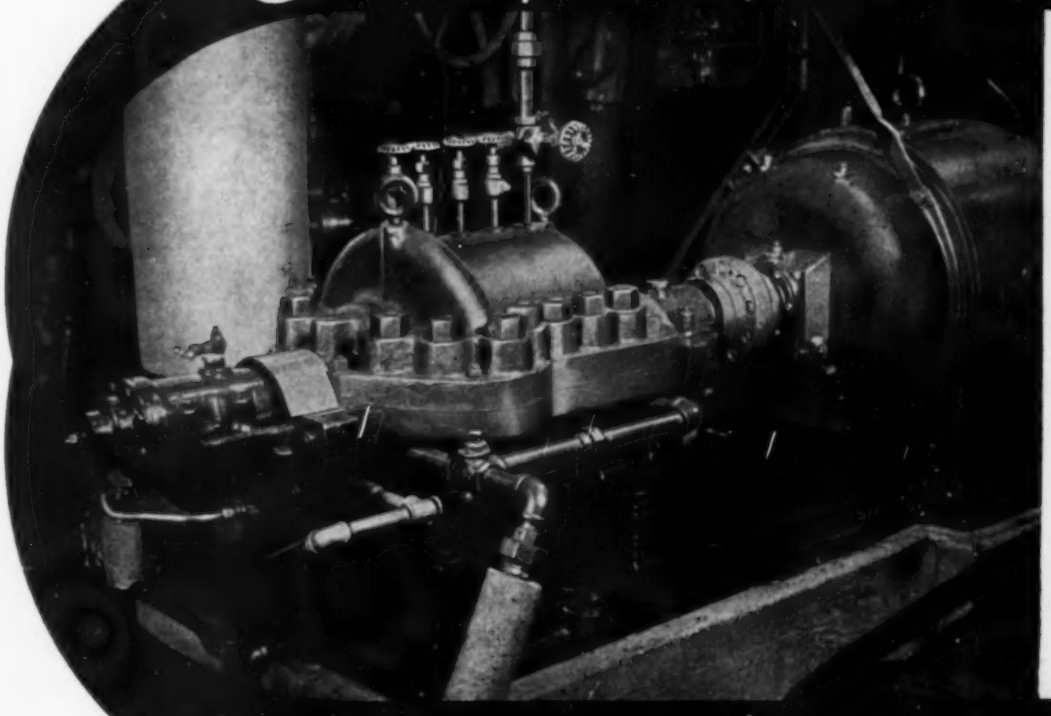

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County Data Book. A supplement to the Statistical Abstract of the United States. Price $2.75. Buckram. A 440-page book issued by the Department of Commerce. Also carries the designation House Document 340 of the 80th Congress. This is a compilation of social and economic data by counties where such information is available.

Basic Industrial Location Factors. Department of Commerce, Industrial Series No. 74. Price 25 cents. This is a June 1947 revision of the "Guide for Evaluating an Area's Resources for Industrial Development."

Annual Reports. Beginning during December each bureau, department, and independent agency has prepared formal reports to Congress, summarizing operations and achievements of the fiscal year which ended June 30, 1947. In many cases these represent the most convenient way in which to make a review of all activities of a bureau. In most cases printed copies in pamphlet form are available from the bureau in which one is interested. No routine distribution of such material is maintained by anyone. But the Superintendent of Documents' monthly list announces each as printed.

Minerals Yearbook, 1946. Bureau of Mines. Bound volume is expected sometime during the spring. Inquiries regarding subjects of individual chapters should be addressed to the Bureau. Most chapters are for sale by the Superintendent of Documents at 5, 10, or 15 cents each.

Tungsten Investigations in the Republic of Argentina, 1942-43. By Ward C. Smith and E. M. González. Geological Survey Bulletin 954-A. Price 75 cents.

Annual Report of Research and Technologic Work on Explosives, Explosions, and Flames, Fiscal Year 1946. By Bernard Lewis. Bureau of Mines, Report of Investigations R. I. 4176. Mimeographed.

Some Observations on German Coal Research and Developments. By H. H. Lowry and H. J. Rose. Bureau of Mines, Information Circular I. C. 7422. Mimeographed.

Effects of Moisture on Float-and-Sink Testing of Lignite. By H. M. Cooper, et al. Bureau of Mines, Report of Investigations R. I. 4184. Mimeographed.

Sulfur in Low-Gravity Fractions of Some Bituminous Coals. By Thomas Fraser and William L. Crentz. Bureau of Mines, Report of Investigations R. I. 4167. Mimeographed.

Pilot-Plant Distillation and Purification of Titanium Tetrachloride. By C. Kerby Stoddard and Emil Pietz. Bureau of Mines, Report of Investigations R. I. 4153. Mimeographed.

Laboratory Beneficiation of Disseminated Fluorspar Ores. By M. M. Fine and R. G. O'Meara. Bureau of Mines, Report of Investigations R. I. 4158. Mimeographed.

Concentration of Utah Fluorite Ores. By H. D. Snedden, et al. Bureau of Mines, Report of Investigations R. I. 4143. Mimeographed.

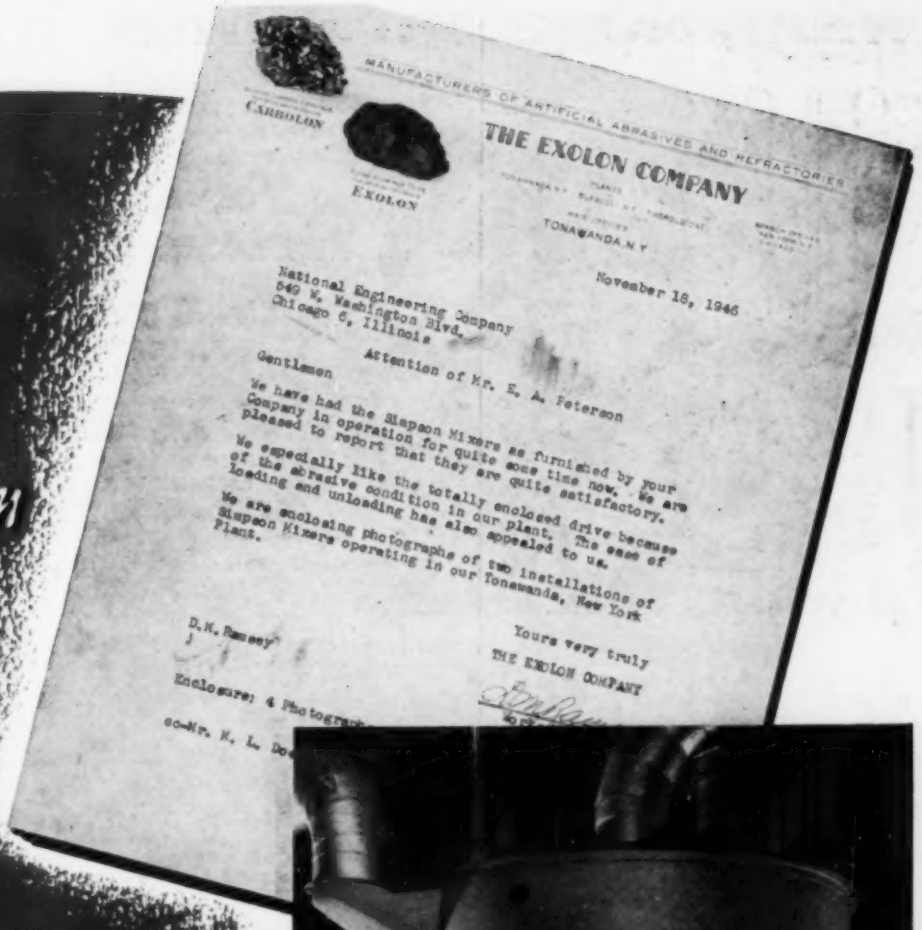
A Mine Air-Conditioning Chart. By G. E. McElroy. Bureau of Mines, Report of Investigations R. I. 4165. Mimeographed. Interesting charts and data applicable to plant as well as mine conditions.

Electrowinning of Manganese from Domestic Ores. By J. H. Jacobs. Bureau of Mines, Report of Investigation R. I. 4163. Mimeographed.

Electrolytic Manganese in Acid and Basic Electric Steel Foundry Practice and Basic Steel Ingot Production. By F. Sillers, et al. Bureau of Mines, Report of Investigations R. I. 4157. Mimeographed.

Concentration of Gravity Tailings from the Grasselli Deposit, Park City, Utah. By T. F. Mitchell, et al. Bureau of Mines, Report of Investigations R. I. 4159. Mimeographed.

Another report of satisfaction from a user of SIMPSON MIXERS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Attention of Mr. E. A. Peterson

Gentlemen

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We especially like the totally enclosed drive because of the abrasive condition in our plant. The ease of loading and unloading has also appealed to us.

We are enclosing photographs of two installations of Simpson Mixers operating in our Tonawanda, New York Plant.

Yours very truly
THE EXOLON COMPANY

D.M. Ramsey
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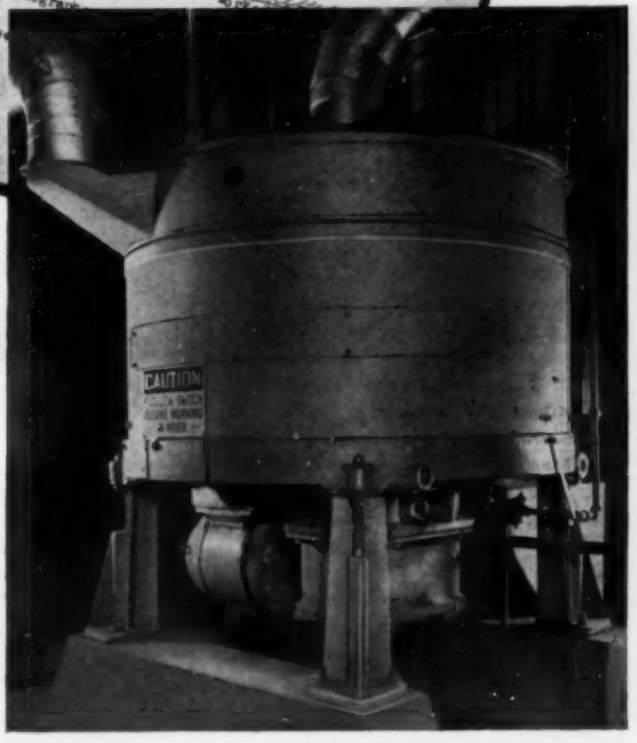
Enclosure: 4 Photograph

cc-Mr. H. L. Do



The accompanying letter typifies the satisfactory performance that users are getting from their Simpson Intensive Mixers. Actual results prove that these heavy duty mixers not only stand up under the constant grinding and wearing action of materials like abrasives...but that they do a more thorough job faster, at extremely low operating and maintenance costs.

Ask to have a National Engineer show you how Simpson Mixers can solve your mixing problems involving dry, semi-dry and plastic materials

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(Continued from page 170)

synchronous timing motors and other industrial timing devices made by this company.

117. Steam Turbines. Whiton Machine Co., New London, Conn.—8-page booklet illustrating and describing this company's line of steam turbines ranging from 5 to 1,200 hp. catalog ST 101.

118. Engineering Design. Sam Tour & Co., Inc., New York.—4-page leaflet featuring the engineering services available from this company.

119. Chemicals. Glyco Products Co., Inc., Brooklyn, N. Y.—92-page catalog listing the organic chemical compounds manufactured by this company.

120. Tantalum. Fansteel Metallurgical Corp., North Chicago, Ill.—20-page booklet describing the physical, chemical and electrical properties of tantalum.

121. Packaging Equipment. Triangle Package Machinery Co., Chicago.—4-page leaflet illustrating and describing the package filling machines made by this company.

122. Wire Cloth. Newark Wire Cloth Co., Newark.—4-page leaflet covering the company's complete line of wire cloth products.

123. Agitators. The American Pulley Co., Philadelphia.—6-page pocket size leaflet illustrating and describing the tank agitators made by this company.

124. Protective Clothing. B. F. Goodrich Co., Akron.—Catalog section 12,000 contains 12 pages illustrating and describing the line of industrial protective clothing made by this company.

125. Instruments. Wilkens-Anderson Co., Chicago.—Bulletin B-212. 8-page booklet illustrates and describes the model 14 Coleman Universal Spectrophotometer.

126. Power Cylinders. Miller Motor Co., Chicago.—Bulletin A-105 contains eight pages featuring the air cylinders made by this company. Construction details are shown in a cutaway view. Bulletin H104 illustrates and describes hydraulic cylinders.

127. Instruments. Ess Instrument Co., Bergenfield, N. J.—4-page bulletin No. 429 illustrates and describes the specific gravity instruments made by this company. Also Bulletin No. 604 featuring this company's turbidity recorder.

128. Valves. Hauck Mfg. Co., Brooklyn, N. Y.—Bulletin No. 707. 4-page booklet illustrating and describing the self-cleaning, metering oil valves made by this company. Details of construction are illustrated.

129. Valves. Jenkins Bros., New York.—12-page illustrated pocket size folder describes the Fig. 270-U bronze gate valve with Monel seat ring.

130. Waste Treatment. Hardinge Co., Inc., York, Pa.—4-page folder describing and illustrating the equipment made by this company for treating industrial waste. Includes flocculating equipment, sand filters, classifiers, thickeners and clarifiers.

131. Chemicals. Eston Chemicals, Inc., Los Angeles.—A new booklet published by this company gives complete informa-

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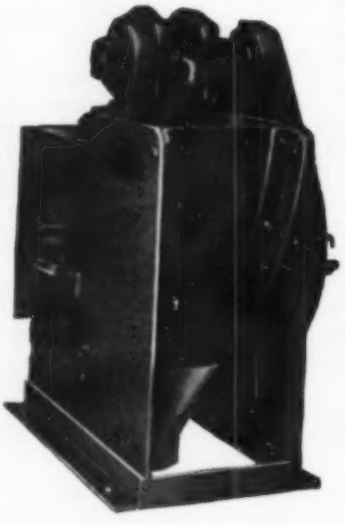

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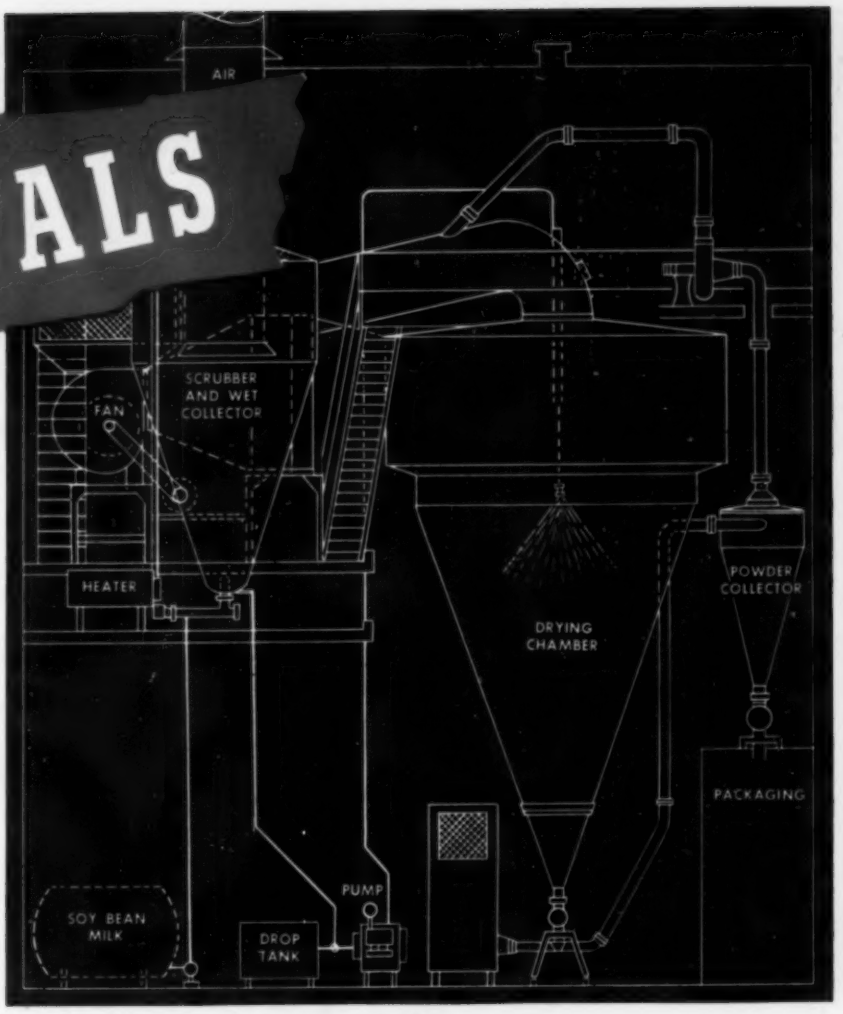
Spray Dryers



The versatility of the Swenson Gray-Jensen Process of spray drying permits innumerable adaptations. Plant layout and equipment are designed to provide drying temperatures and conditions compatible with the nature of the product, and at the same time to afford over-all economy of operations.

The Swenson Process has many important advantages over other drying methods:

- Material is converted from liquid to powder in a single pass.
- Low product temperature—particle temperature need rise only slightly above wet-bulb temperature of the gas, thus avoiding injury to heat-sensitive materials.
- High temperature, high capacity production—practical and economical for handling materials of non-heat-sensitive nature.
- All welded alloy construction for parts in contact with liquid, vapor, or solids.
- Drying may be accomplished in multiple stages, giving full control of moisture content of the finished product.
- Solids are totally recovered—there is no loss, and no problem of dust in the plant or neighborhood.

Full plant-scale test runs may be arranged quickly at the Swenson Spray Dryer Research Laboratory at reasonable cost. This is good insurance! If you have a product which can benefit from the advantages of spray drying, write at once for information.

SWENSON EVAPORATOR CO.

Division of WHITING CORPORATION Harvey, Ill.

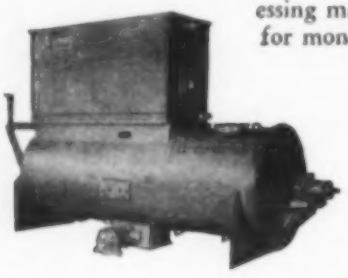
Export Department: 30 Church Street, New York 7, N. Y.

WANT ABSOLUTE UNIFORMITY IN YOUR MIXED MATERIALS?

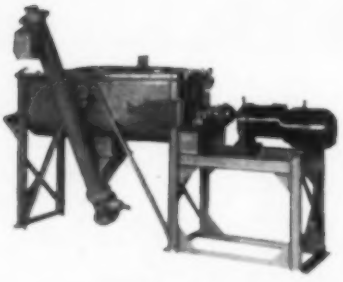
Accepted industry-wide as the best means of obtaining maximum uniformity in mixed materials, the horizontal mixer as manufactured by Sprout-Waldron sets new high standards of efficiency.

Horizontal mixers are generally considered "tops" for uniformity of their resultant mixture. This fine uniformity is secured in all S-W horizontal mixers from the 2½ cu. ft. capacity up to and including the huge 550 cu. ft. mixers. Sprout-Waldron will custom build a mixer to meet your needs no matter how special they may be. We fabricate mixers from practically any metal or wood . . . jacket them for "cooking" or "cooling" . . . line them with glass, porcelain, rubber, etc.

Buy Sprout-Waldron for the finest in processing machinery . . . look to Sprout-Waldron for money-saving advice.



DUST-TIGHT VENTED MIXER
This completely agitated, vented mixer with dust-tight assembly and brush sifter is a part of a unique S-W Intimate Blending System now producing agricultural dusts of unmatched uniformity. 1 to 11 tons per hour capacity.



HORIZONTAL STAINLESS STEEL MIXER
A compact, self-contained unit designed especially for a pure food product.

CUSTOM BUILT MIXER
Our experience, our engineering and manufacturing facilities are unequalled for the design and fabrication of special mixers. Manufactured from stainless steel, non-ferrous metal, wood, ordinary steel or cast iron, and lined with glass, porcelain, rubber, etc., as desired.

SPROUT-WALDRON & COMPANY

Manufacturing Engineers

MUNCY PENNSYLVANIA

tion on the use and application of Bromofume, an ethylene dibromide soil fumigant for use in the control of wire worms and certain nematodes.

132. Materials Handling. Jeffrey Mfg. Co., Columbus, Ohio.—Catalog 75. 164-page indexed catalog covering the complete line of belt conveyors and auxiliary equipment made by this company. Contains design and engineering data, for the purpose of aiding in the selection of this type of equipment. Includes prices.

133. Instruments. Emil Greiner Co., New York.—8-page booklet illustrating and describing the automatic vacuum and pressure control made by this company. Known as the Cartesian Manostat, this is a laboratory instrument that can be adapted to certain industrial applications. Bulletin ICM 96.

134. Alloy Fittings. Northern Indiana Brass Co., Elkhart, Ind.—Catalog No. 901 contains eight pages illustrating and describing the Nibcoloy wrought fittings made by this company.

135. Protective Coatings. Ferro Chemicals Corp., Cleveland.—Bulletin 18 contains technical information to help paint formulators select metallic soap concentrations that minimize the loss of drying power in black paint enamels.

136. Pumps. Byron Jackson Co., Los Angeles.—Bulletin 47-8020 illustrates and describes the Hydroplex pump made by this company. This is a vertical multi-stage centrifugal pump for low capacity, high-pressure pumping with high efficiency.

137. Instruments. Industrial Instruments, Inc., Jersey City, N. J.—Bulletin entitled "Conductivity Measurements in Boiler Operation" describing manual and automatic equipment for measuring the conductivity of condensed steam, boiler water, raw water and pump condensate.

138. Instruments. Schutte & Koerting Co., Philadelphia.—Bulletin 18-R is a two-page leaflet illustrating and describing the beaded glass tube used in this company's rotameters. This tube contains three equally spaced guides or flutes for guiding the float.

139. Safety Valve. Farris Engineering Corp., Palisades Park, N. J.—6-page illustrated condensed specification bulletin No. 50 illustrates 31 different valves by means of line drawings.

140. Materials Handling. Pallet Sales Corp., New York.—24-page Pallet Buyers Guide contains information design to assist in planning or extending pallet operation.

141. Chemicals. Onyx Oil & Chemical Co., Irvington, N. J.—Two leaflets Nos. Ind.-2 and Ind.-3 describe wetting agents made by this company.

142. Screens. Patterson Foundry & Machine Co., East Liverpool, Ohio.—10-page Catalog No. 477 illustrates and describes the line of Gyro-centric screens made by this company. The various models are illustrated by photographs and dimensions are shown in tabular form.

143. Belt Conveyors. Robins Conveyor Div., Hewitt-Robins, Inc., Passaic, N. J.—Bulletin No. 120-A1 contains information on laying out belt conveyors for conveyor systems. Illustrates and describes this company's equipment.

144. Motors. Fairbanks, Morse & Co., Chicago.—Bulletin 2760, 16-page booklet, features the axial air gap motor made by this company. Features of construction are illustrated by photographs and cutaway views. Contains tables of dimensions.

145. Industrial Fans. Sutorbilt Corp., Los Angeles.—2-page leaflet featuring industrial fans made by this company.

146. Power Transmission. D. O. James Gear Mfg. Co., Chicago.—Catalog 1,000 is a 535 page catalog describing and illustrating this company's gears and gear reducers. Includes extensive engineering data, rating tables, horsepower capacities, weights and prices.

147. Pumps. Warren Steam Pump Co., Inc., Warren, Mass.—6-page bulletin No. 241 features the 4- and 6-stage volute centrifugal pump made by this company.

COPPUS "BLUE RIBBON" VENTILATORS

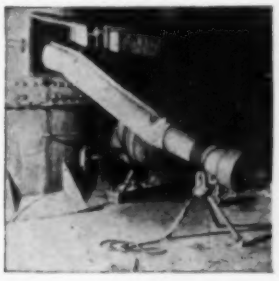
identified by the blue band

FOR WORKERS'

- *Safety*
- *Health*
- *Comfort*
- *Efficiency*

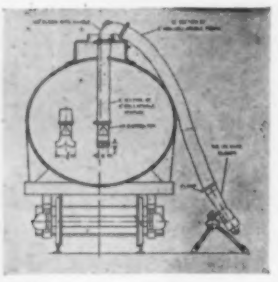
VANO Design "A" VENTILATOR

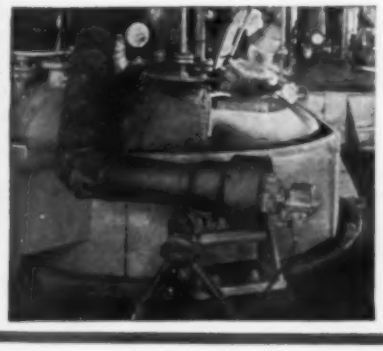
Vano Design "A" cooling interior of furnace, supplying fresh air through 10 feet of "Ventube" to provide safety and comfort during repair work.



Vano Design "A" delivering fresh air to cable manhole, expelling sewer gas, making entrance safe in a few minutes.

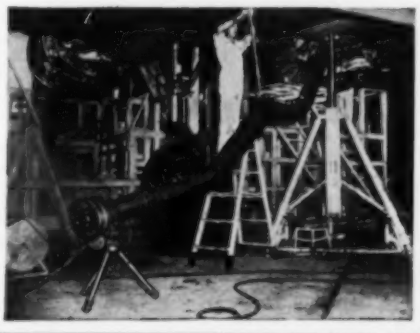
Vano Design "A" Ventilator plus a few accessories feeds large air volume into tank car, driving out fumes, stagnant or hot air for workers' safety and comfort.





Vano Design "A" supplying fresh air in Reactor Room of Synthetic Rubber Plant.

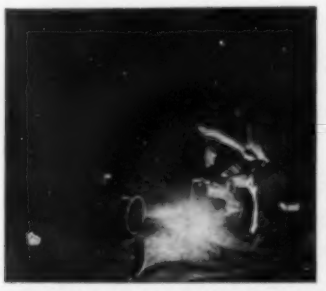
Vano Design "A" Ventilator supplying fresh air to men working in wing compartments, fuselages, etc.



Powered by a ½ hp motor, and equipped with the exclusive Coppus axial-flow propeller-type fan, this general-purpose blower delivers 1500 CFM of fresh air. It supplies ventilation for tanks, tank cars, drums, vats, underground cable manholes, pipe galleries, airplane wing compartments and fuselages, and other confined places. Weighs only 103 lbs. Uses 8"-diameter flexible canvas tubing ("Ventube").

VANO DESIGN "C"

VENTILATOR-EXHAUSTER



Vano Design "C" equipped with 8" discharge tubing removing welding fumes.

Vano Design "C" equipped with two suction lines removing welding fumes for operators' safety.

For withdrawing welding fumes from confined places or directly from the welding rod ...or for expelling fumes or hot air from enclosed vessels. You can get it with 8" suction inlet for 8" non-collapsible tubing ...or with multiple inlet nozzles for 5", 4" or 3" suction hose. The discharge outlet takes 8" "Ventube". Powered by a ½ hp motor, it weighs only 85 lbs.

COPPUS ENGINEERING CORP., 222 PARK AVENUE, WORCESTER 2, MASS.
Please send information on the Blowers that clear the air for Action.

- ☐ in tanks, tank cars, drums, etc.
- ☐ in underground cable manholes.
- ☐ in aeroplane fuselages, wings, etc.
- ☐ on coke ovens.
- ☐ on steam-heated rubber processes.
- ☐ on boiler repair jobs.

COOLING:

- ☐ motors, generators, switchboards.
- ☐ wires and sheets.
- ☐ general man cooling.
- ☐ around cracking stills.
- ☐ exhausting welding fumes.
- ☐ stirring up stagnant air wherever men are working or material is drying.

NAME.....

COMPANY.....

ADDRESS.....

CITY.....

(Write here any special ventilating problem you may have.)

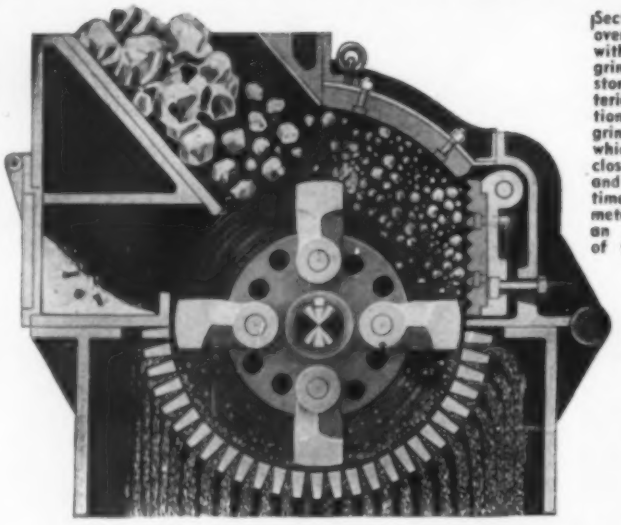
COPPUS "BLUE RIBBON" PRODUCTS—*Designed for Your Industry, Engineered for You*

Williams

OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD

PATENT CRUSHERS GRINDERS SHREDDERS

HEAVY DUTY HAMMERMILLS



Sectional view of Williams over-running hammermil with heavy liners and grinding plate for limestone and other hard material. Particular attention is directed to the grinding plate adjustment which assures uniform close contact of hammers and grinding plate at all times. Also note the metal trap which provides an outlet for the escape of tramp iron.

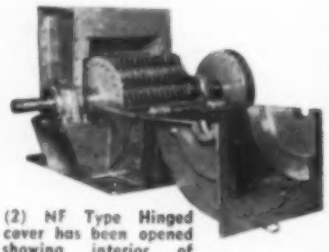
Reduces

ANIMAL
MINERAL
VEGETABLE
MATTER

STANDARD MACHINES for Practically Any Reduction Job

(1) Williams HM Type Pulverizer

CHEMICALS, SOAP CHIPS, ETC. Hundreds of chemicals are being ground with the machines shown here.



(2) NF Type Hinged cover has been opened showing interior of mill.

OIL CAKE, INCLUDING SOYA, COPRA AND COTTONSEED. Expeller cake as well as hydraulic press cake is satisfactorily ground for animal food.

ANIMAL AND FISH BY-PRODUCTS. Thousands in operation grinding cracklings, tankage, fish scrap, raw and dry bones, etc.

(3) Another view of NF Type. Notice heavy flywheel at right.

GARBAGE, SEWAGE. Many in operation grinding garbage from municipalities and canneries.

STEEL, ALUMINUM AND OTHER METAL TURNINGS. All can be easily handled in Williams Mills to permit easier handling by conveyor or shovel.

ROOTS, HERBS, BARK AND CHIPS. Various vegetable substances can be successfully shredded previous to extraction processes.

THE WILLIAMS PATENT CRUSHER & PULVERIZER CO.

2706 North Ninth St. **St. Louis, Mo.**

Sales Agencies Include

Chicago	New York	Philadelphia
37 W. Van Buren St.	15 Park Row	11 N. Fourth St.

Details of construction are shown in a cutaway view.

148. Materials Handling. Standard Conveyor Co., St. Paul, Minn.—Bulletin No. 61. 16-page bulletin illustrating and describing the line of standard gravity and power conveyors made by this company.

149. Boilers. Eclipse Fuel Engineering Co., Rockford, Ill.—Bulletin A106. 8-page folder describing the gas fired automatic unit boilers made by this company.

150. Materials Handling Equipment. Syntron Co., Homer City, Pa.—92-page catalog illustrating and describing the complete line of vibratory materials handling equipment available from this company. Includes information on construction and maintenance tools.

151. Ion Exchange Equipment. Liquid Conditioning Corp., Linden, N. J.—Catalog G-1. 60-page bulletin describing the equipment and materials for conditioning water and other liquids. Diagrammatic illustrations show principles of construction and operation of various processes and equipment for ion exchange treatment of liquids.

152. Kilns. Allis-Chalmers Mfg. Co., Milwaukee, Wis.—32-page illustrated bulletin No. 07B6368 describes rotary kilns for cement, lime and chemical plants.

153. Boiler Equipment. The Steel Improvement & Forge Co., Cleveland.—32-page catalog No. 11 illustrates and describes boiler and tank accessories such as handhole and manhole covers and other similar types of equipment.

154. Platinum Catalyst. American Platinum Works, Newark, N. J.—10-page pocket-sized booklet describing the characteristics and applications of platinum and palladium catalysts.

155. Steam Specialties. Yarnall-Waring Co., Philadelphia.—Bulletin WG1811 contains 20 pages illustrating and describing the water columns and gages made by this company. Liberally illustrated with diagrams and cutaway views to show principles of operation, construction details and dimensions of the various pieces of equipment.

156. Materials Handling. Crescent Truck Co., Lebanon, Pa.—6-page bulletin illustrates and describes the new electric Palletier model MDVH fork truck.

157. Combustion Equipment. Bryant Heater Co., Cleveland.—Data Sheet No. 1A-6. 4-page booklet describing the atmospheric type pipe burner made by this company. Contains information on application requirements, capacity ratings, specifications; includes capacity selection table. Data sheet No. 1B-1 illustrates and describes coil-caged gas burners for firing immersion coils using atmospheric and blast equipment. Well illustrated with drawings and includes information on the selection and installation of this type of equipment.

158. Chemicals. Koppers Co., Inc., Pittsburgh, Pa.—Technical Bulletin C-7-104 gives properties and reactions of sec-butylbenzene.

159. Micro Switches. Micro Switch, Freeport, Ill.—2-page data sheet No. 41 illustrating and describing the Model SK skeleton switches for applications requiring a low cost snap action switch unit.

160. Instruments. The Bristol Co., Waterbury, Conn.—6-page folder describing this company's time controller. Discusses and diagrams its principle of operation. Enumerates the various uses and applications of the controller.

162. Gaskets. Melrath Supply & Gasket Co., Inc., Philadelphia, Pa.—64-page catalog listing and illustrating the gaskets and gasket materials made by this company. Contains specifications, sizes and other engineering data.

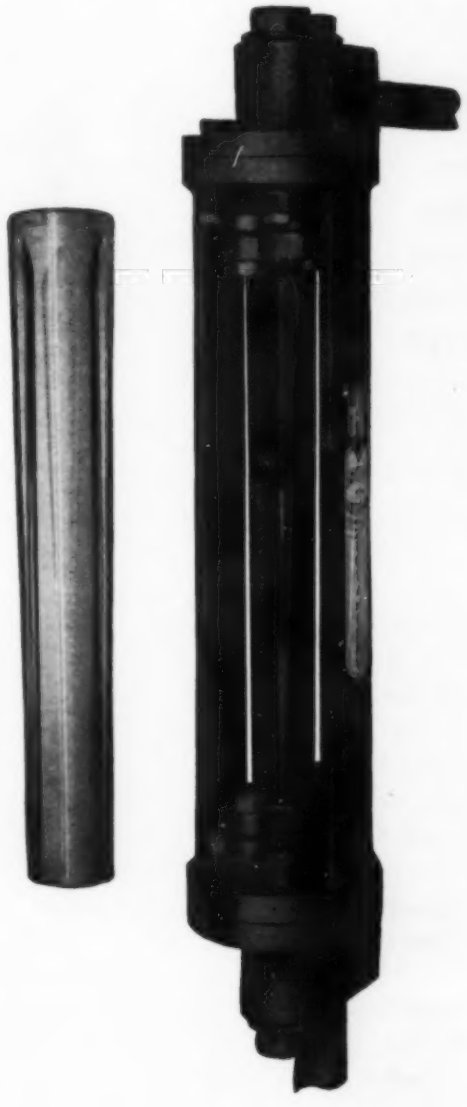
163. Equipment. The Babcock and Wilcox Co., New York, N. Y.—Four bulletins describe the boilers, equipment for steam separation in boiler drums, oil burners and air heaters manufactured by this company.

164. Protective Coating. Lithgow Corp., Chicago, Ill.—8-page booklet describes

an ƒK "reason why"

increases capacity and reading accuracy

ƒK type HCF tube



The ƒK Type "HCF"* Tube . . .

Increases Rotameter capacity . . .
Provides stability for rotors of various designs . . .
And assures easy, accurate reading . . .
Of fluid rate-of-flow . . .
Clear or opaque.

Three equally spaced guides or flutes . . .

Center and guide the rotor . . .
Throughout the length of the tube scale.

The intimate contact . . .

Of the rotor and flutes . . .
Insures rotor visibility . . .
And metering accuracy.

You can convert your ƒK Universal Rotameter . . .

And gain the advantages . . .
Of the Type "HCF" Tube . . .
At a reasonable cost.

Write for Supplement 3 to Bulletin 18-R . . .

And get complete details.

*High Capacity Fluted

SCHUTTE and KOERTING Company

Manufacturing Engineers

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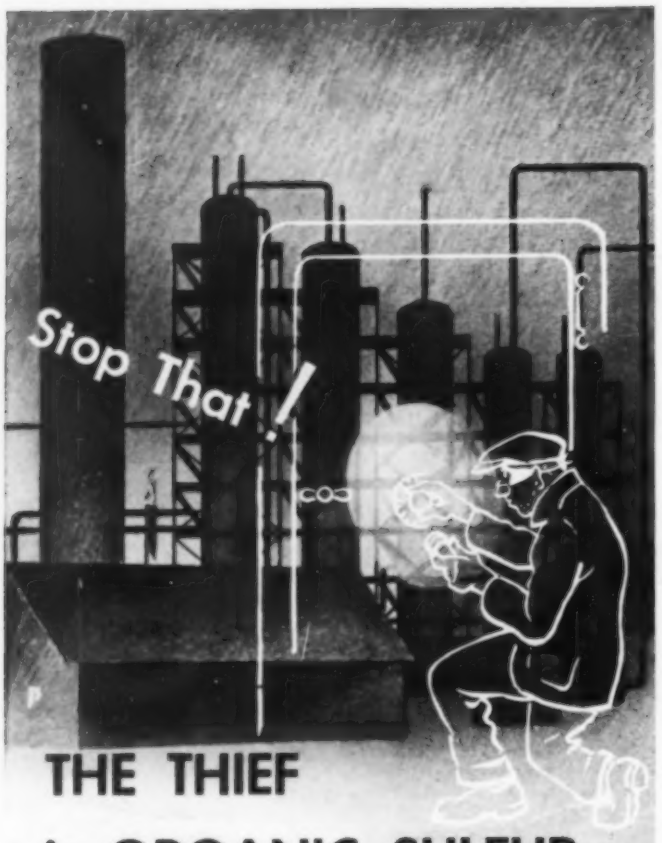
JET APPARATUS • CONDENSERS AND VACUUM PUMPS • HEAT TRANSFER EQUIPMENT
VALVES • ROTAMETERS • FLOW INDICATORS • GEAR PUMPS • STRAINERS
OIL BURNING EQUIPMENT • SPRAY NOZZLES AND ATOMIZERS • RADIAFIN TUBES



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is ORGANIC SULFUR

Catalytic removal of objectionable sulfur compounds has been found to work great improvement in the leaded octane numbers of most gasolines. At the same time, "sour" distillates are "sweetened."

FLOREX* and *Florite**

are inexpensive natural catalysts which modern refiners use with the most satisfactory results in their desulfurization processes. Samples and technical data are available on request. Inquiries are welcomed.

*Trademark Registered

FLORIDIN COMPANY, INC.
ADSORBENTS
220 Liberty Street Warren, Pa.

and pictures the use of this company's protective lining for steel and other metals.

165. Materials Handling. Hewitt-Robbins Inc., Passaic, N. J.—Bulletin 128-A. 12-page booklet describes the Robins Car Shakeout for unloading hopper-bottom cars. Pictures and diagrams the working of the unit.

166. Thermocouple Gage. National Research Corp., Boston, Mass.—4-page leaflet describing this company's line of thermocouple gage controls. Lists physical and operational specifications for each.

167. Instruments. Sperry Products, Inc., Hoboken, N. J.—6-page data sheet describing this company's gage for thickness measurement and inspection of bond. Contains explanations and diagrams showing its principle of operation.

168. Paint. Witco Chemical Co., New York, N. Y.—2-page report discusses the hiding power of the titanium dioxide and lithopone enamel manufactured by this company. Provides the formulations of both products.

169. Chemicals. Atlas Powder Co., Wilmington.—8-page pocket sized leaflet describing Sorbitol and its wide variety of applications.

170. Combustion Systems. Surface Combustion Corp., Toledo, Ohio.—12-page reprint of an article entitled "Combustion Systems and Burners." Describes gas-fired combustion systems and burners. Contains sectional drawings of burner equipment.

171. Equipment. Denver Equipment Co., Denver.—Bulletin G4711. 8-page bulletin listing and describing briefly the new and used equipment items for sale by the company. Includes classifiers, filters, thickeners, crushers, pH indicators, motors, pumps and tanks.

172. Spectrophotometer. National Technical Laboratories, South Pasadena, Calif.—Bulletin 153-B. A 10-page bulletin describing and illustrating the Beckman model 1R2 infrared spectrophotometer for use in laboratory investigations and plant control systems. Describes design and construction, performance and other features. Gives instrument and accessory equipment prices.

173. Electrodes. National Technical Laboratories, South Pasadena, Calif.—Bulletin 86-C. This 10-page publication is devoted to the line of pH electrodes and accessory equipment for use with the Beckman pH instruments. Each item is briefly described and illustrated. Prices included.

174. Process Equipment. Fluor Corp., Ltd., Los Angeles.—Catalog 46. A 20-page general catalog dealing with the line of cooling towers, pulsation dampeners, and mufflers. Describes services offered by the firm. Contains engineering data.

175. Insulation. Pacific Lumber Co., San Francisco, Calif.—A 12-page cold storage manual featuring advantages of the firm's Palco redwood bark insulating wool. Gives cross-sectional drawings to show best methods of use in various types of construction. Well illustrated.

176. Insecticides. Eston Chemicals, Inc., Los Angeles.—Bulletin T-100. A 2-page mimeographed form announcing Tetron, the firm's new homogeneous mixture of neutral tetraethyl pyrophosphate and other ethyl esters of polyphosphoric acids. Outlines properties, method of applying and insecticidal effectiveness.

177. Valves. The Duriron Co., Dayton, Ohio—Bulletin 615 contains four pages describing the Durco corrosion-resisting Y and angle valves made by this company.

178. Bleaching Clays. Los Angeles Chemical Co., Los Angeles.—A 2-page folder describing briefly the properties and industrial uses of this firm's Lacconite brand bleaching and filtering clays.

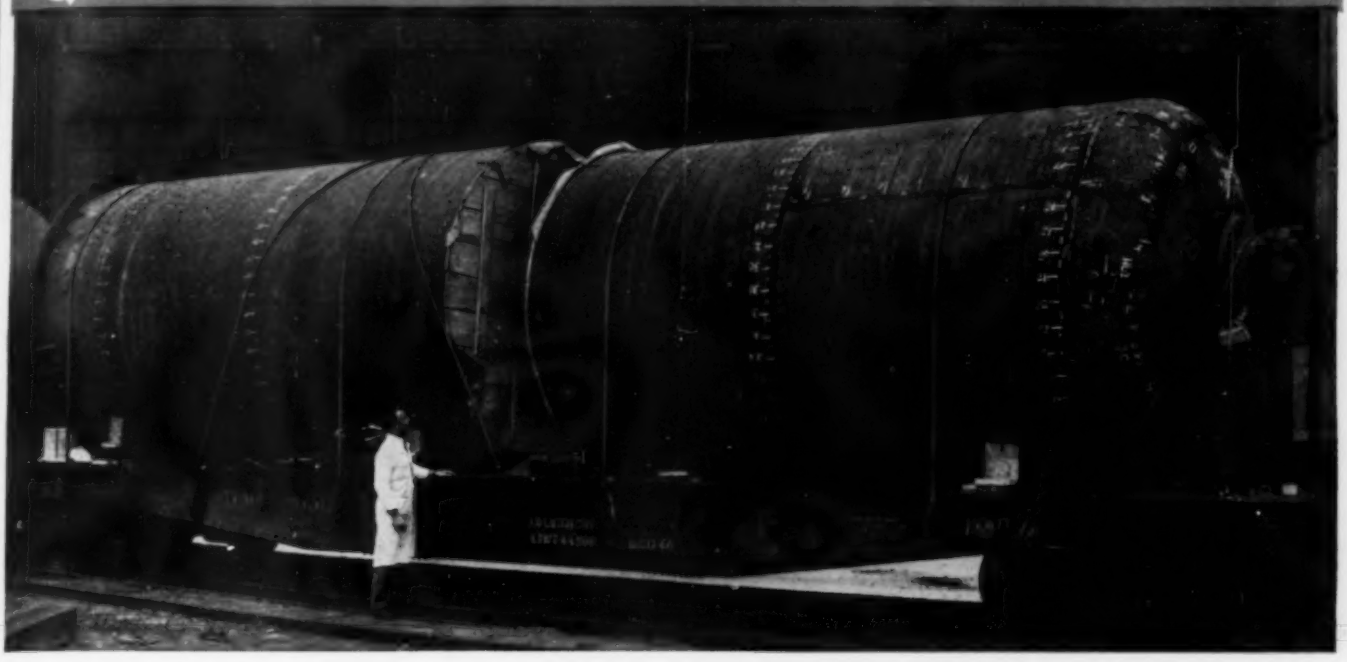
179. Weighing. Yale & Towne Mfg. Co., Philadelphia. — 16-page bulletin No. P714-C illustrates and describes the new platform scale made by this company. Principles of operation are described and

VESSEL DIVISION

NEWS

A. O. SMITH Corporation

New York 17 · Philadelphia 3 · Pittsburgh 19 · Atlanta 3 · Chicago 4
Tulsa 3 · Houston 2 · Seattle 1 · Los Angeles 14
International Division: Milwaukee 1

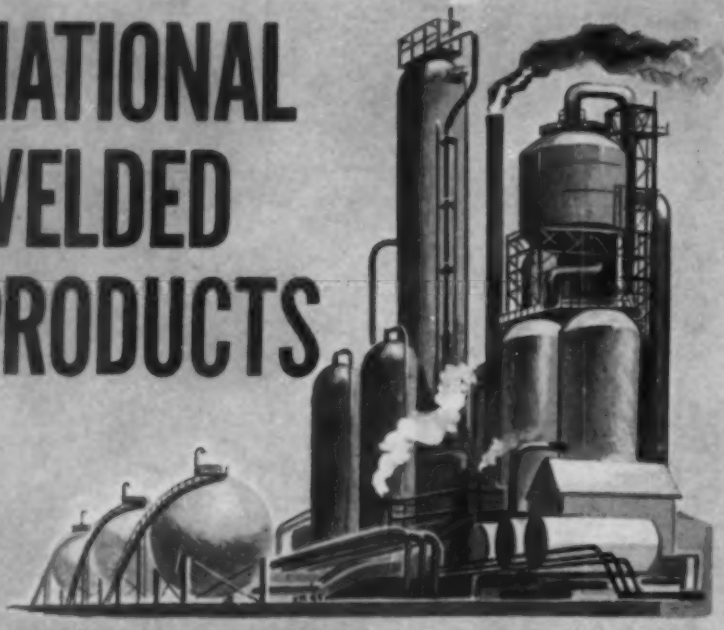


SLICED IN HALF. Remember the man who built a boat in his basement and then had to tear down a wall to get it out? Well, in this case A. O. Smith fabricated a 43 ft. long lined digester in halves and saved tearing down a wall to install it in an existing paper mill building.

TURN-ABOUT STRESS-ANNEALING. Even the longest of A. O. Smith's huge furnaces could not stress anneal all of this oil industry vessel at the same time; so one half was heated and cooled then the vessel was turned around and the other half stress annealed.

RECORDING 200,000 PSI TENSILE TEST. Through constant research in the field of high strength alloy steel weld metal, A. O. Smith is producing an alloy steel electrode whose weld metal strength is over 200,000 psi when heat treated.

NATIONAL WELDED PRODUCTS



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CHEMICAL PLANTS
PETRO CHEMICAL PLANTS
REFINERIES
STEEL INDUSTRIES

FROM OPEN HEARTH, STAINLESS, ALLOY AND CLAD STEELS

Pressure Vessel
8' 0" x 10' 4⅝" long.
A.S.M.E. Code—U-68.
Plate thickness ¾"

Dependability is the byword for National Welded Products. It is built into every phase of engineering and production—to assure you of pressure vessels and other fabricated equipment that meets exacting codes and requirements. Let us work with you in solving your difficult fabricating problems.

Pressure Vessel
Section 54" I. D.
x 11' 9⅝"
Plate thickness ⅞"

NATIONAL PRODUCTS

- Pressure Vessels
- Galvanizing Kettles
- Annealing Covers
- Tin Pots
- Salt Annealing Pots
- Wire Annealing Pots
- Special Welded Tanks

National
ANNEALING BOX COMPANY
API-ASME Codes • Stress Relieving • X-ray
Pledged to Quality Since 1895
WASHINGTON, PENNA.

FOR MORE INFORMATION
See Reader Service
Coupon on pages 169-170

illustrated and construction details are shown.

180. Filters. General American Transportation Corp., New York.—Bulletin No. 105, containing 4 pages, describes and illustrates the Conkey rotary leaf pressure filters made by this company. Application, operation and construction of these filters are discussed.

181. Nylon Products. The Polymer Corp., Reading, Pa.—6-page pocket size leaflet describing physical properties, fabrication, and recommended uses for nylon rod and strip.

182. Calcining Furnace. Victor J. Nelson Engineering & Construction Co., Burbank, Calif.—Bulletin No. 100A is a 4-page leaflet featuring the Nelson inclined furnace No. 5 for the calcination, burning and processing of metallic and non-metallic ores. Details of construction and operation are illustrated with diagrammatic sketches. Also available from this company is a chart showing some of the functions and uses of lime. Use of lime for a wide number of applications is indicated in the process industries.

183. Silica Gel. The Davison Chemical Corp., Baltimore.—Bulletin No. 401 illustrates and describes silica gel dehydrators for compressed air and gases. This 16-page booklet is well illustrated with photographs of different models and with line drawings showing dimensions. Also 4-page leaflet containing information on inert gas generators for blanketing, purging and other process use.

184. Engineering Services. Southwestern Engineering Co., Los Angeles, Calif. —Bulletin 702 illustrates a number of process plants and installations made by this company.

185. Load Cells. Baldwin Locomotive Works, Philadelphia, Pa.—Three leaflets Nos. 264, 270, and 271 describing and illustrating different types of load cells made by this company.

186. Water Treating. Industrial Chemical Sales, Div. West Virginia Pulp & Paper Co., New York.—164-page book entitled "Taste and Odor Control in Water Purification." Book discusses the use of activated carbon in water treating.

187. Magnetic Pulleys. Eriez Mfg. Co., Erie, Pa.—8-page illustrated booklet featuring the permanently magnetized non-electric magnetic pulley made by this company. Application and operation of the pulley is described and a table gives data for determining pulley size for a variety of granular materials.

188. Drills. Ingersoll-Rand Co., Phillipsburg, N. J.—4-page folder illustrating and describing this company's air operated rock drill. Contains photographs showing various applications of the drill.

189. Welding. John Nooter Boiler Works Co., St. Louis.—14-page booklet describing and illustrating this company's services in the field of metal fabrication. Contains two pages of corrosion data.

190. Equipment. Surface Combustion Corp., Toledo.—32 page booklet illustrates and describes this company's equipment for the heat treating of metals. Contains a tabular resume of prepared gas atmospheres giving composition, application, capacities and cost.

191. Screw Pumps. Sier-Bath Gear and Pump Co., North Bergen, N. J.—20-page catalog describes the capacity and applications of the company's screw pumps. Includes information on hp. ratings, viscosities, pump installation and maintenance.

192. Humidity Control. Surface Combustion Corp., Toledo.—8 page bulletin discussing this company's unit for humidity control in air conditioning systems for industrial processing. Contains a full-page flowsheet showing operation. Explains details of application. Shows several different installation views.

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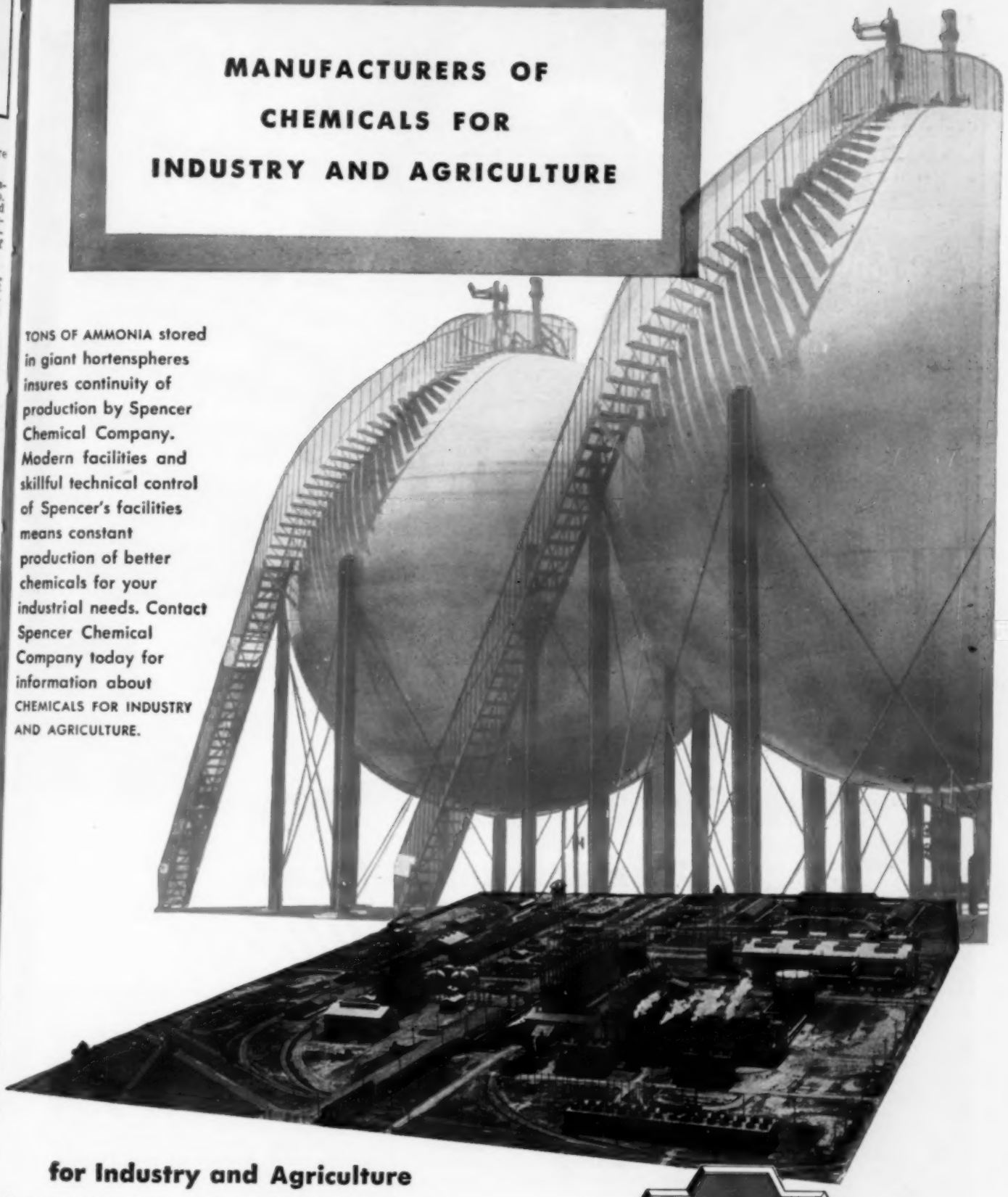

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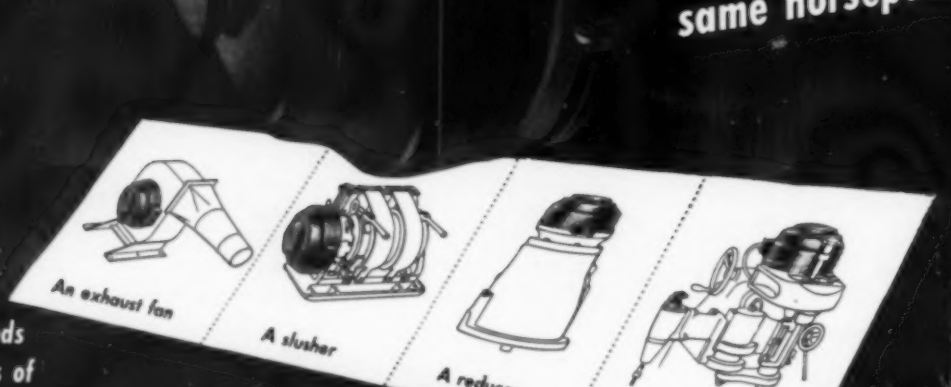

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CHEMICAL ECONOMICS

H. M. Batters, MARKET EDITOR

PRODUCTION AND CONSUMPTION OF CHEMICALS MAY REACH NEW HIGH IN FIRST QUARTER

BECAUSE of the work done last year in the way of rehabilitation of equipment and the installation of new facilities, the chemical industry entered this year with a larger productive potential. Some of the large consuming industries including fertilizer, steel and petroleum operated on a rising scale in the latter part of 1947 and currently are maintaining this trend. Hence, prospects seem bright for establishing a new high this quarter for both production and consumption of chemicals. A year ago manufacturing operations were on a high plane and the *Chemical Engineering* index for consumption of chemicals stood at 221.52 for the first quarter. Any large percentage increase over this average in the corresponding three months of this year is not to be expected but a moderate rise seems certain if unforeseen conditions do not arise to upset calculations.

Fertilizer output in the last calendar year is estimated at approximately 16,500,000 tons and the industry is working on schedules which should bring an increase of nearly 10 percent for the present year. Current movement of fertilizer chemicals is seasonally high but later declines from the peak periods may be limited by the necessity to operate plants on a fairly even monthly basis in order to reach the over-all objective.

Producers of steel stepped up their rate of activities last August and the upward movement still is in effect. Some of the less efficient plants were to be closed at the end of 1947 but consuming requirements have proved so pressing that these plants are to be kept in operation. Use of chemicals in the steel industry in the January-March months this year may run about 5 percent above that reported for the comparable period of last year.

Demand for petroleum products has moved up so sharply that refining operations have been expanded. In the last few months, runs to stills have been increased and now are averaging considerably higher than the wartime peak. However, full requirements are not being met. Necessity for full-scale activities at refineries has a direct bearing on the outlook for chemical requirements in that field.

Considered purely from a standpoint of supply and demand large outputs of pulp and paper would be assured for the months immediately ahead. Limiting factors however, may be found in availability of raw materials.

Glass outputs were reduced somewhat in the last two months of last year and a window glass plant was closed temporarily in January because of shortage of fuel. On the other hand, the over-all outlook is favorable. Glass containers must continue to carry a heavy part of the packaging load.

Chemical Engineering Index

Industrial Consumption of Chemicals

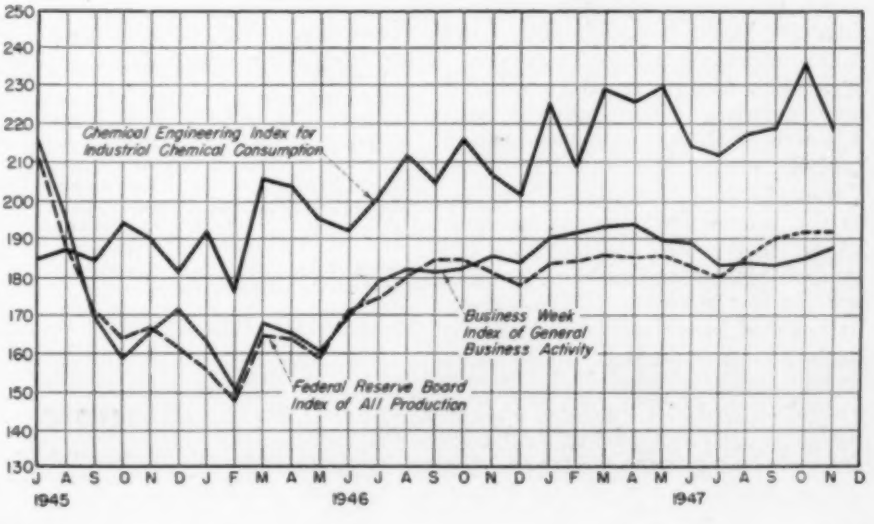
1935 = 100

	Oct. Revised	Nov.
Fertilizers	53.54	52.06
Pulp and paper	24.39	22.95
Petroleum refining	21.03	20.26
Glass	22.25	19.45
Paint and Varnish	24.95	19.66
Iron and steel	13.69	13.28
Rayon	25.16	23.56
Textiles	11.56	10.80
Coal products	11.00	10.74
Leather	5.25	5.00
Explosives	8.70	7.66
Rubber	6.11	5.40
Plastics	8.55	7.77
	236.18	218.59

Plate and window glass, both of which established new record outputs last year, should at least duplicate that performance this year.

Sales of paint, varnish and lacquer reached such a high dollar value last year that doubts are heard about the ability of the industry to repeat that accomplishment. If the building program comes along as outlined the volume of paint and kindred products required may surpass the tonnage sold last year.

The influence of rubber in the chemical field has grown from the time synthetic rubber made its appearance in volume. First there is the effect it had on production of such chemicals as butadiene and styrene; then the relatively larger use of chemicals in compounding the synthetic product, and finally the perpendicular rise in total rubber consumption. While consumption of rubber will be high this year, industry estimates generally agree that use of synthetic will be cut back and that total tonnage of all rubber consumed will be below the 1947 figure. The position of the chemical-consuming industries may be summarized by saying that most of them are finding a receptive market for their products; several have more productive capacity than they had a year ago and in most cases are able to fill their raw material requirements more satisfactorily; and in reverse, some lines are barely holding their own or are faced with a moderate drop from their peaks.



Acetic Acid and Acetic Anhydride

Synthetic Production of These Chemicals Faces a Bright Future With the Cellulose Acetate Industry

COMMODITY SURVEY

Acetic acid and its anhydride are the twins of the cellulose acetate industry. They are associated in use, and are therefore considered together here. There is a small amount of natural acetic acid made, but it will not be included in this article. Trade circles believe that demand for both acid and anhydride will exceed supply for the next few years.

Production of these chemicals has been growing steadily. Output of new synthetic acid has grown from 120 million pounds in 1939 to over 365 million pounds in 1947. This is an increase of 80 million pounds over 1946. Anhydride production has grown from 181 million pounds in 1939 to over 608 million pounds in 1947. This was 86 million pounds above 1946 output.

Acetic acid and acetic anhydride are made by three types of producers. They are cellulose acetate producers, manufacturers of synthetic chemicals and fermenters. Among the first group are Celanese Corp. of America, E. I. du Pont de Nemours & Co., Tennessee Eastman Corp. and Hercules Powder Co.

As a general rule the other chemical companies make acid and anhydride for resale. Some companies produce alcohol and have found it profitable to produce acetic acid from this raw material. This group includes companies like Publicker Industries Inc., and Commercial Solvents Corp.

Acetic acid is produced from several raw materials. Commercial Solvents Corp. uses alcohol and acetaldehyde and has plants at Angew, Calif., and Peoria, Ill. E. I. du Pont de Nemours & Co. uses a high pressure synthesis at Belle, W. Va., to produce acetic acid. Methanol and carbon monoxide are the raw materials. This company is reported to use acetylene as a raw material for anhydride at Waynesboro, Va., and it is building a new anhydride unit at Houston, Tex. The Celanese Corp. of America is operating a butane-propane oxidation process to produce acetic acid at Bishop Tex. Tennessee Eastman Corp. is producing acid and anhydride (by acid pyrolysis) at Kingsport, Tenn. Niacet Chemical Div., U. S. Vanadium Corp., a subsidiary of Carbide and Carbon Chemicals Corp., is using acetylene to produce acetic acid at Niagara Falls, N. Y. This was the first company to produce synthetic acetic acid on a large scale in the United States. Carbide and Carbon has plants in Texas City, South Charleston, W. Va., and Whiting, Ind., which produce acetic anhydride from acetone by the Wacker process. This company also makes acetic acid from alcohol and acetaldehyde.

End Uses

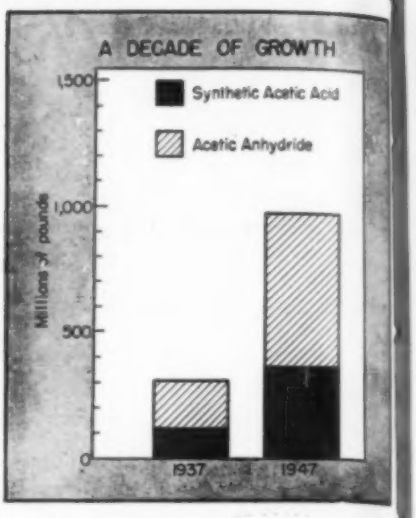
A study of producers of this acid and anhydride indicates that cellulose acetate flake is the chief end use for these chemicals. It is estimated that 60 percent of the acid is consumed in cellulose acetate flake, 30 percent in the production of acetate esters, and 10 percent is consumed in miscellaneous uses such as textile processing, metallic acetates, drugs, paints and pigments, rubber chemicals and photography.

Most of the anhydride (about 95 percent) goes into cellulose acetate flake for rayon and plastics. Relatively small amounts go into aspirin, perfumes, flavor bases, and textile processing. Demand for anhydride for flake is increasing as acetate rayon grows in importance in the rayon industry. The growth of acetate rayon is clearly evident if we look at rayon plant capacities. In November 1946, capacity of acetate plants consisted of 197 million pounds of yarn and 42 million pounds of staple fiber. At the present time acetate rayon capacities are estimated at 243 million pounds of yarn and 77 million pounds of staple fiber. By the last half of 1949 it is estimated that acetate rayon capacity will be 322 million pounds of yarn and 100 million pounds of staple.

In computing the amount of material needed to produce one pound of flake, it is normally assumed that 1.77 lb. of anhydride is used in the process while only 0.5 lb. is consumed. The remainder is collected as spent acid. On this basis it can be seen that 747 million pounds of anhydride will be required for these plants to operate at capacity. The 1947

Carbide and Carbon is expanding its anhydride capacity and this expansion is scheduled for completion in April 1949. Celanese is working on process improvements in existing units and will be improving the yields of present equipment. Hercules Powder Co. is reported to have started producing anhydride last year at Parlin, N. J. Du Pont is building an anhydride plant at Houston.

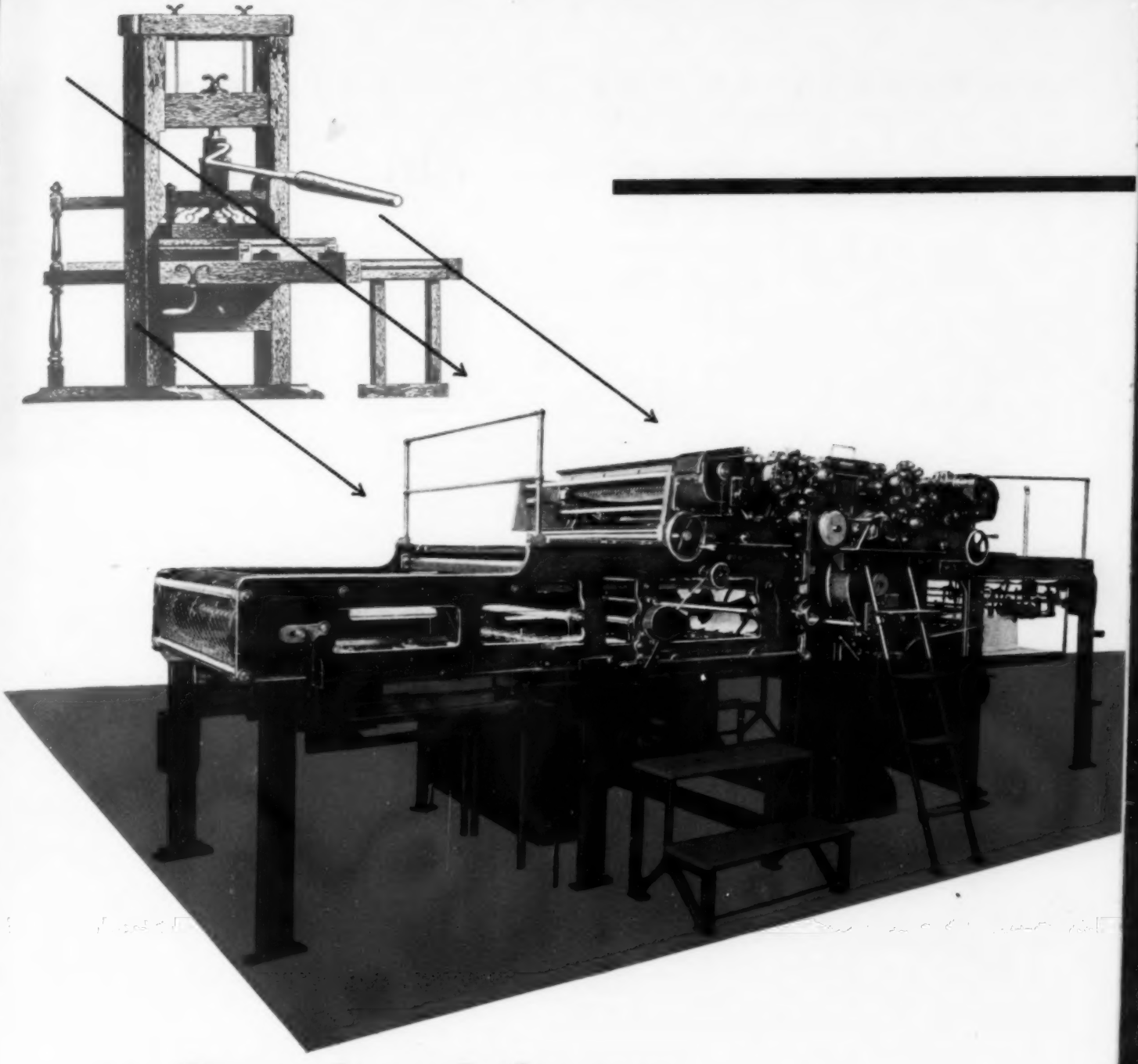
Cost outlook for anhydride depends on the purchasing power of the dollar. There is no increase around the corner, but this material will run below and parallel to the general cost curve in the future. At the present time 12c. per lb., in large quantities, is a fair price. The price had been firm for several years, but last October it rose to the current level. Present acid prices range from 7.62 to 8.62c. per lb., for large lots.



Synthetic Acetic Acid and Acetic Anhyride Producers

Company	Plant Location
Commercial Solvents Corp.*	Agnew, Calif. Peoria, Ill.
E. I. du Pont de Nemours & Co.	Belle, W. Va. Waneesboro, Va.
Celanese Corp. of America	Bishop, Tex. Cumberland, Md. Narrows, Va.
Tennessee Eastman Corp.	Kingsport, Tenn.
Niacet Chemicals Division, U.S. Vanadium Corp.*	Niagara Falls, N. Y.
Carbide and Carbon Chemicals Corp.	Texas City, Tex. South Charleston, W. Va. Whiting, Ind.
Publicker Industries, Inc.*	Philadelphia, Pa.
Hercules Powder Co.†	Parlin, N. J.

* Acid only † Anhydride only



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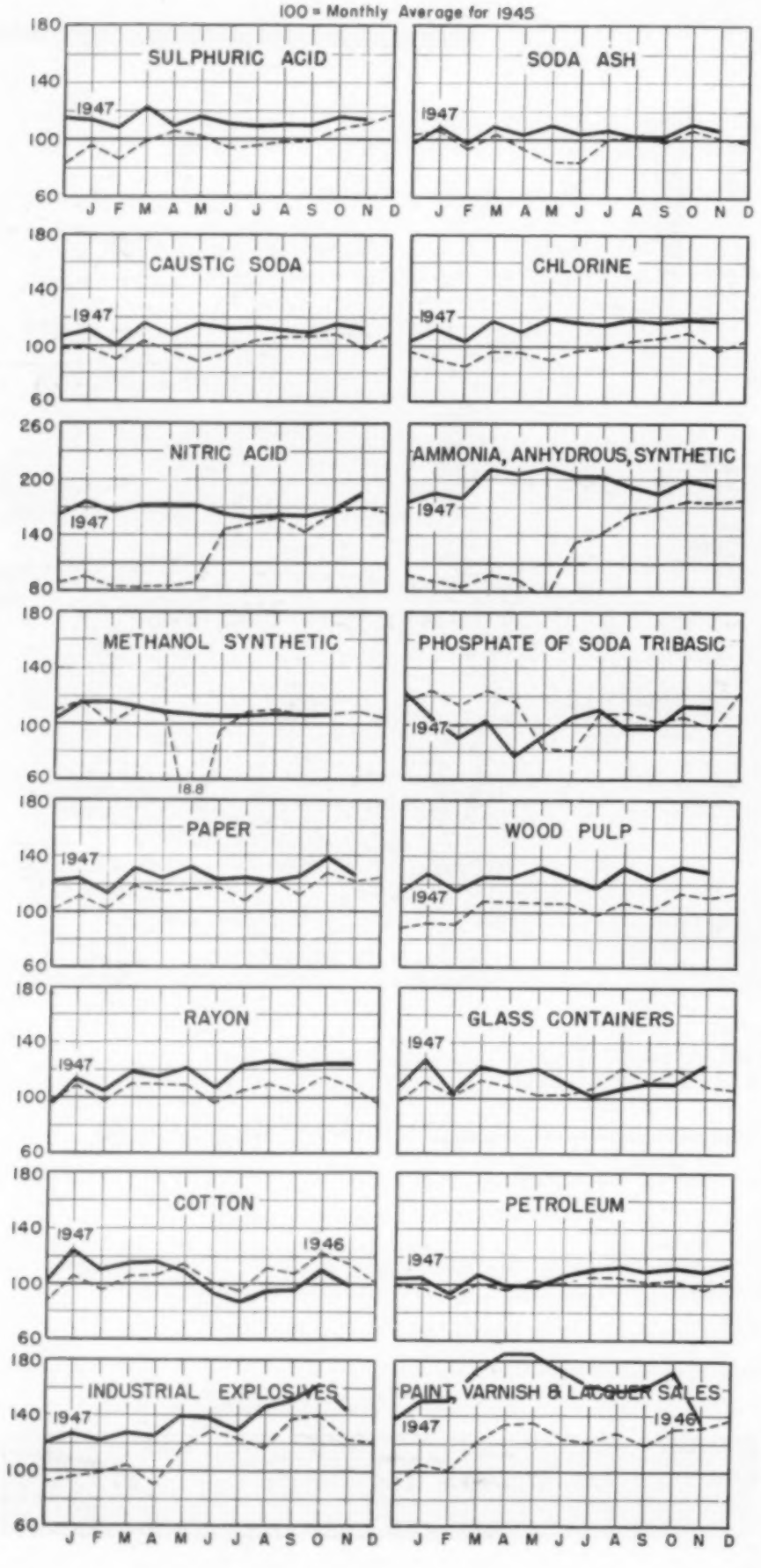
PRODUCTION AND CONSUMPTION TRENDS



WHILE AN upward production trend last year was fairly general throughout the chemical industry the rate of increase was far from uniform for the various divisions. Summation of the monthly data issued by the Bureau of the Census shows that, in the heavy chemical field, production of fertilizer chemicals increased at a rate far ahead of the average for all chemicals. This was a logical development in view of the added capacity made available by the transfer of idle government plants to private operators. Furthermore, demand for fertilizer was so active there was a real incentive to run producing plants at close to capacities.

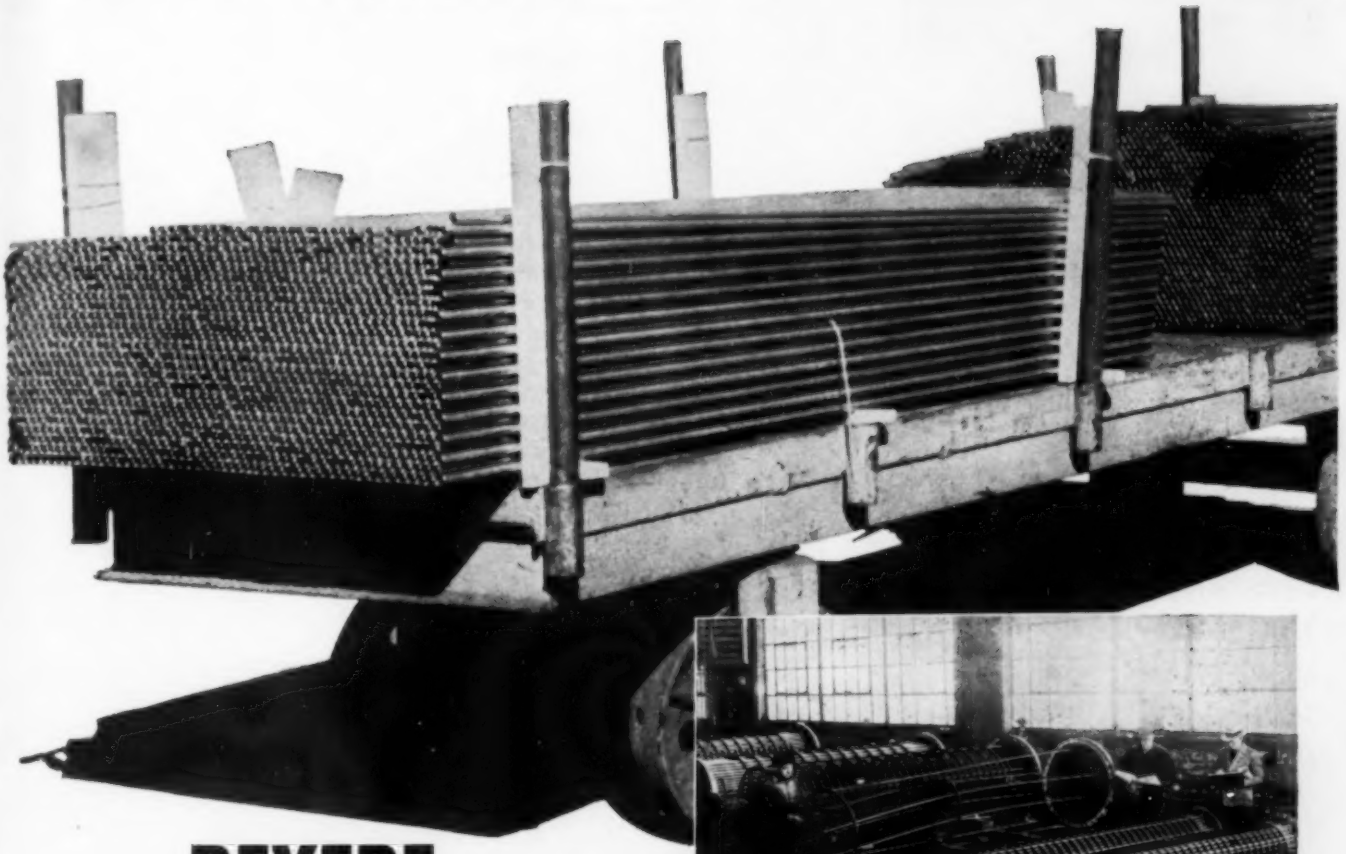
Tracing monthly progress in the alkali branch brings out the fact that a fairly even production schedule was carried out with some early-year gains coming from added producing units. Sulphuric acid, with outlets in practically every consuming line, made a new production record by entering 1947 at a high level and consistently holding that differential over the preceding year up to the closing months when the 1946 and 1947 rates grew closer together.

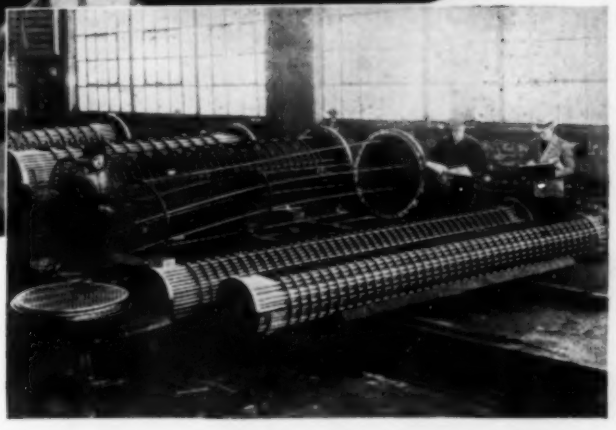
Producers of synthetic methanol had to struggle along without much in the way of new facilities but were able to reach a new yearly high for their product because plants were kept in constant operation in contrast to the enforced cuts experienced in the preceding year. Actually there is a decidedly upward trend in methanol manufacture despite the fact that it has been deferred. Consuming requirements are larger than the supply and plans for enlarging facilities were made long ago but for different reasons, these plans will not be realized until some time this year.

In the principal chemical-consuming fields, cumulative monthly data indicate that most of the regular outlets for chemicals were enlarged last year. Pulp and paper plants ran above their 1946 rates throughout the twelve months and as plans for numerous new projects have been announced, any later change in the direction of the trend will not be due to lack of producing capacity.

In textiles, cotton was consumed in a large way in the first four months and then dropped below the monthly averages maintained in the corresponding months of the previous year. Estimates for cotton consumption this year indicate some drop in the average monthly movement.

MEETING SPECIAL CONDITIONS





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United States Production of Certain Chemicals

November 1947, November 1946 and Eleven-Month Totals for 1947 and 1946

(Tons unless otherwise noted)	November 1947	November 1946	Total, Eleven Months 1947	Total, Eleven Months 1946
Ammonia, synthetic, anhydrous[1]	87,616	80,380	990,966	643,314
Ammonium nitrate 100 percent	86,214	81,733	954,462	623,136
Ammonium sulphate, synthetic, technical (M lb.)	28,748	37,921	355,985	292,737
Calcium arsenate (M lb.)	2,709	1,330	44,756	34,634
Calcium carbide, commercial	48,462	55,312	552,994	518,208
Calcium phosphate (M lb.)				
Monobasic	6,608	7,109	65,472	68,109
Dibasic	4,921	5,624	69,645	64,780
Carbon dioxide				
Liquid and gas (M lb.)	16,376	15,437	226,733	201,219
Solid (M lb.)	44,838	46,611	681,938	604,024
Chlorine	117,210	97,135	1,258,160	1,052,498
Chrome green (M lb.)	868	1,265	12,181	16,611
Chrome yellow and orange (M lb.)	4,290	3,083	44,758	39,986
Hydrochloric acid 100 percent	37,526	30,150	386,263	310,872
Hydrogen (M cu. ft.)	2,103,000	1,525,000	19,674,000	16,110,000
Lead arsenate, acid and basic (M lb.)	.....	2,865	.....	51,941
Molybdate chrome orange	343	286	3,971	4,489
Nitric acid 100 percent	67,996	63,277	691,669	511,377
Oxygen (M cu. ft.)	1,212,000	1,006,000	12,542,000	10,840,000
Phosphoric acid 50 percent	89,453	82,020	949,249	814,837
Soda ash				
Ammonia-soda process				
Total wet and dry[2]	379,821	368,302	4,129,488	3,808,862
Finished light[2]	185,558	176,446	2,003,373	1,802,288
Finished dense	136,257	136,626	1,500,961	1,305,716
Natural[4]	24,893	15,063	257,453	190,111
Sodium bicarbonate, refined	15,053	15,580	176,461	172,956
Sodium bichromate and chromate	7,527	7,176	79,891	89,933
Sodium hydroxide				
Electrolytic process				
Liquid[5]	112,402	92,524	1,221,543	1,030,630
Solid	23,533	13,848	222,886	177,997
Lime-soda process				
Liquid[5]	61,419	60,751	688,009	678,042
Solid	19,863	20,374	224,198	206,444
Sodium phosphate				
Monobasic	1,100	986	12,993	10,826
Dibasic	6,993	5,676	72,119	53,931
Tribasic	8,251	7,185	81,559	85,906
Meta	2,784	2,012	28,509	23,927
Tetra	5,025	4,428	50,766	50,028
Sodium silicate, anhydrous	45,233	34,442	434,901	377,833
Sodium sulphate				
Anhydrous, refined	10,802	9,229	124,194	111,483
Glauber's salt[3]	16,573	15,242	181,477	152,384
Salt cake, crude, commercial[3]	54,672	37,252	570,724	477,657
Sulphuric acid[6,7]				
Chamber process	275,356	266,037	2,992,528	2,835,631
Contact process, new	549,778	524,119	6,040,951	5,095,153
Zinc yellow (zinc chromate) (C. P.)	244	203	2,952	.....

Data for this tabulation have been taken from "Facts for Industry" series issued by Bureau of the Census. Production figures represent primary production and do not include purchased or transferred materials. Quantities produced by government-owned arsenals, ordnance works, and certain plants operated for the government by private industry are not included. Chemicals manufactured by TVA, however, are included. All tons are 2,000 lb. Where no figures are given data are either confidential or not yet available. [1]Includes a small amount of aqua ammonia. [2]Total wet and dry production, including quantities diverted for manufacture of caustic soda and sodium bicarbonate, and quantities processed to finished light and finished dense. [3]Not including quantities converted to finished dense. [4]Data collected in cooperation with the Bureau of Mines. [5]Figures represent total production of liquid material, including quantities evaporated to solid caustic and reported as such. [6]Includes oleum grades, excludes spent acid. [7]Data for sulphuric acid manufactured as a byproduct of smelting operations are included.

United States Production of Certain Synthetic Organic Chemicals

October 1947, October 1946 and Ten-Month Totals for 1947 and 1946

Chemical	October 1947	October 1946	Total, Ten Months 1947	Total, Ten Months 1946
Acetanilid, technical and USP	616,315	1,134,531	6,466,068	.....
Acetic acid:				
Synthetic[1]	27,302,164	24,980,328	302,981,271	228,540,326
Recovered	128,529,127	110,563,661	1,186,899,041	973,511,121
Natural[2]	2,257,951	2,806,758	21,385,961	23,365,435
Acetic anhydride[3]	55,070,604	46,376,409	506,914,787	428,243,673
Acetone	34,349,765	25,975,688	326,413,610	270,560,257
Acetylsalicylic acid	1,092,162	710,143	10,330,400	7,877,585

(Continued on page 318)

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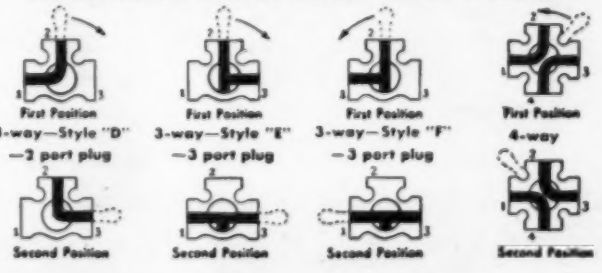

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U. S. Production of Synthetic Organic Chemicals (Cont. from page 316)

	October 1947	October 1946	Total, Ten Months 1947	Total, Ten Months 1946
Aniline	10,113,469	8,924,437	88,928,858	73,197,350
5-Ethyl-5-phenylbarbituric acid and salts (phenobarbital)	56,791	29,683	304,208	321,561
Benzene:				
Motor grade:				
Tar distillers[4]	.....	810,345	.....	7,787,673
Coke-oven operators[5]	1,103,515	3,099,833	13,883,701	26,055,862
All other grades:				
Tar distillers	1,521,110	1,208,588	17,918,788	17,260,306
Coke oven operators	12,561,363	11,208,111	116,942,011	86,225,897
Butyl alcohol, normal, primary	10,347,112	11,791,405	118,004,250	99,248,967
Carbon bisulphide	30,492,113	27,444,008	290,546,189	247,981,905
Carbon tetrachloride	14,919,436	16,527,880	163,137,907	122,360,970
Chlorobenzene, mono	27,442,195	22,360,088	270,166,267	221,003,790
Creosote oil:				
Tar distillers[4]	10,634,301	9,721,110	101,931,237	92,119,337
Coke-oven operators[5]	3,309,459	4,148,976	32,807,410	23,150,708
Cresols:				
Meta-para	541,853	414,783	5,168,123	4,798,875
Ortho-meta-para	628,046	832,095	7,633,228	.....
Cresylic acid, refined[7, 10]	2,403,254	2,455,799	21,796,165	19,549,191
Dibutyl phthalate	1,721,008	1,481,857	17,426,623	.....
Dichlorodiphenyltrichloroethane (DDT)	2,587,994	3,788,544	42,294,983	37,091,008
Ethyl acetate (85%)	7,180,805	8,744,934	69,756,205	75,992,991
Ethylene glycol	21,732,477	.....	179,622,568	.....
Ethyl ether	3,472,841	3,003,670	34,212,999	33,372,197
Formaldehyde (37% by wt.)	40,576,943	41,863,814	430,326,704	379,153,711
Hexachlorocyclohexane	1,052,635	.....	5,016,238	.....
Methanol:				
Natural[8]	1,540,520	1,464,220	13,561,948	13,182,445
Synthetic	46,910,007	43,776,937	448,330,452	404,123,256
Naphthalene:				
Tar distillers, less than 79°C	18,296,820	17,351,924	187,441,858	153,441,943
Tar distillers, 79°C and over	7,009,722	8,752,881	81,896,394	80,135,948
Coke-oven operators, less than 79°C	7,942,663	8,425,254	78,775,399	57,257,633
Penicillin[9]	4,745,212	2,633,629	30,639,567	21,731,932
Phenol, synthetic and natural	24,694,170	18,369,252	219,490,451	161,233,410
Phthalic anhydride	12,529,039	9,275,629	115,715,591	87,113,767
Streptomycin	1,308,893	.....	.....	.....
Styrene, government owned plants	25,982,826	29,980,223	251,262,143	310,577,842
Toluene, coke-oven operators	2,568,473	1,466,888	22,241,814	13,439,520
Toluene, all other[8]	4,447,619	2,444,278	29,169,770	12,821,115
Xylene, crude, from coal-tar and petroleum	2,856,642	.....	34,119,750	.....

All data in pounds except benzene (gal.) creosote oil (gal.), toluene (gal.) xylene (gal.) and penicillin (million Oxford units). Statistics collected and compiled by U. S. Tariff Commission except where noted. Absence of data on production indicates either that returns were unavailable or confidential. [1]Excludes the statistics on recovered acid. [2]Acid produced by direct process from wood and from calcium acetate. [3]All acetic anhydride including that from acetic by vapor-phase process. [4]Product of distillers who use purchased coal tar only or from oil-gas or water-gas produced or purchased by tar distillers. [5]Statistics are given in terms of bulk medicinals only. [6]Statistics collected by Bureau of Mines. [7]Total production including data reported both by coke-oven operators and by distillers of purchased coal tar. [8]Reported to U. S. Bureau of the Census. [9]Includes toluene produced from petroleum by any process. [10]Includes refined cresylic acid from petroleum.

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To Stop Tramp Iron Cold!

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- No Operating Cost
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- Easy to Install
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DINGS *New Alnico*
PERMA-PLATE MAGNET:

Here's the low cost answer to your tramp iron problems—keeps iron out of machinery—prevents contamination of your product—stops the danger of sparks. Dings has incorporated highest grade Alnico into a design that makes greatest possible use of its power. Note the raised pole plates—a mechanical and magnetic barrier combined! Can also be installed flush. For positive, low cost, *permanent* protection install a PERMA • PLATE Magnet in chutes and above belts. Standard widths 4" to 72". Write for BULLETIN TODAY. DINGS MAGNETIC SEPARATOR COMPANY, 4730 W. McGeogh Ave., Milwaukee 14, Wis.

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Since 1899

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Key fabrics for key processes. Take filter fabrics, for example. Better filter fabrics mean better production and lower maintenance cost in the wide variety of filtering processes so essential in a great many American industries . . . especially in the chemical and allied industries.

Thanks to forward-looking management, diligent research and exacting manufacturing standards, Wellington Sears has long been famous as a supplier of superior quality filter fabrics. Today, in addition to its wide variety of cotton filter fabrics, Wellington Sears is one of the leaders in the development of amazing new filter cloths from VINYON* brand synthetic resin yarns. This new material is unaffected by moisture—highly resistant to mineral acids and alkalies. Its smooth surface facilitates cake discharge and it does not support fungi or bacteria growths. In short, it keeps filtering equipment in more efficient operation with far less need for stoppage to replace worn out filter cloth.

Filter fabrics, canvas, belting, and many other industrial fabrics; drills and twills for the garment trade; Martex and Fairfax towels; all of the products sold by Wellington Sears are recognized leaders in their respective fields. And because of more than 100 years of experience, Wellington Sears is thoroughly "able" as well as "ready" to help whenever you have a textile problem of any kind.

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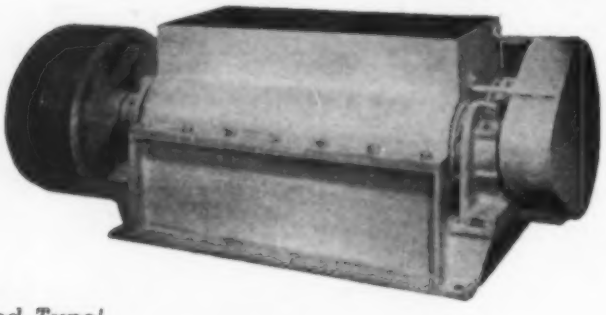
ROBINSON
PROCESSING UNIQUE EQUIPMENT

SAW TOOTH *Crushers*



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Rugged construction. Crushes material to finished size. Blades spaced to your specifications. Capacity from 3 to 15 tons. Roller bearing mounted shaft. Robinson Processing Equipment designed by engineers whose reputation is founded upon doing things right. Literature available. Inquiries invited.

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MERCER-ROBINSON COMPANY, INC.
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Replace
GASKETS
THIS
Better Way

'Standard No. 20 $24.00 a pair
Giant No. 30 $48.00 a pair

These fully-patented FLANGE-JACKS, formerly manufactured by T. G. Persson Co., Bloomfield, N. J., are job-tested and meet the requirements for fast, safe and easy gasket replacement.

Operating with a minimum of effort... vital in tight, cramped quarters... FLANGE-JACKS exert tremendous pressure evenly and smoothly. There is no shock along the pipe line, bolt holes are maintained in perfect alignment, and flange faces cannot be damaged. FLANGE-JACKS eliminate costly shut-downs. See your distributor for trade discounts.

J. H. WILLIAMS & CO., BUFFALO 7, N.Y.

WILLIAMS
Flange-Jacks

CHEMICAL ENGINEERING Weighted Index of Prices for CHEMICALS

Base = 100 for 1937

As of January 1	127.56
Last month (revised)	127.11
February, 1947	123.47
February, 1946	109.13

CURRENT PRICES

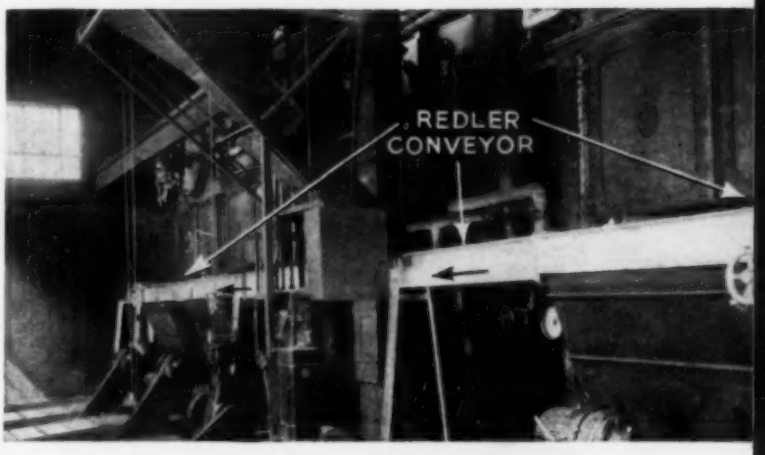
The accompanying prices refer to round lots. Where it is trade custom to sell f.o.b. works, quotations are so designated. Prices are corrected to February 1.

INDUSTRIAL CHEMICALS

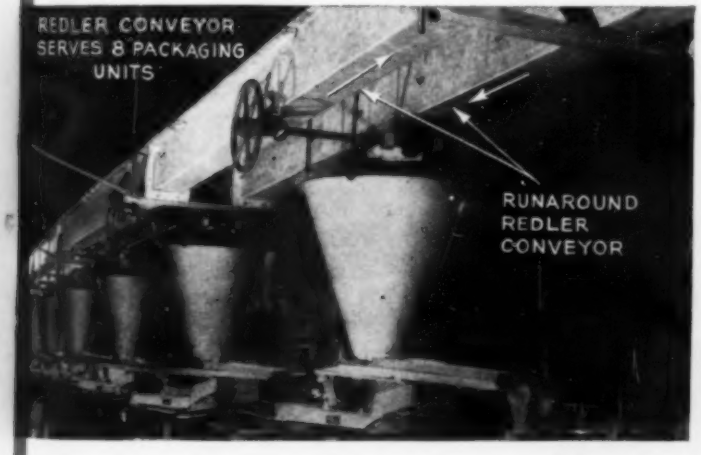
Acetone, tank, lb.	$0.08 - $0.09
Acid, acetic, 28%, bbl., 100 lb.	3.78 - 4.03
Boric, bbl., ton	134.00 - 142.50
Citric, drums, lb.	.24 - .26
Formic, cbys., lb.	.12 - .14
Hydrofluoric, 30%, drums, lb.	.09 - .09½
Lactic, 44% tech., light, bbl., lb.	.0815- .0855
Muriatic, 18%, tanks, ton	18.00 -
Nitric, 36°, carboys, lb.	.05 - .05½
Oleum, tanks, wks., ton	19.50 - 20.00
Oxalic, crystals, bbl., lb.	.13½- .14
Phosphoric tech., tanks, lb.	.04 -
Sulphuric, 60°, tanks, ton	12.25 -
Tartaric, powd., bbl., lb.	.45½- .48
Alcohol, amyl from pentane, tanks, lb	.17 -
Alcohol, butyl, tanks, lb.	.17 - .35
Alcohol, ethyl, denatured, No. 1 special tanks, gal.	.93 - .96
Alum, ammonia, lump, lb.	.04½-
Aluminum sulphate com. bags, 100 lb.	1.15 - 1.25
Ammonia, anhydrous, cyl., lb.	.16 - .20
tanks, ton	50.00 - 61.50
Ammonium carbonate, powd., casks, lb.	.09½- .10
Sulphate, wks., ton	35.00 - 40.00
Amyl, acetate, tech, from pentane, tanks, lb.	.23 -
Aqua ammonia, 26°, drums, lb.	.03 - .03½
tanks, ton	65.00 -
Arsenic, white powd., bbl., lb.	.06½- .07
Barium, carbonate, bags, ton	67.50 - 75.00
Chloride, bags, ton	85.00 - 90.00
Nitrate, casks, lb.	.11½- .12
Blanc fixe, dry, bags, ton	72.50 - 80.00
Bleaching powder, f.o.b., wks., drums, 100 lb.	3.75 - 4.00
Borax, gran., bags, ton	48.50 - 66.00
Calcium acetate, bags, 100 lb.	3.00 -
Arsenate, dr., lb.	.09½- .10
Carbide, drums, ton	70.00 -
Chloride, flake, bags, del. ton	21.50 - 38.00
Carbon bisulphide, drums, lb.	.05½- .06½
Tetrachloride, drums, lb.	.07 - .07½
Chlorine, liquid, tanks, wks., 100 lb.	2.25 - 2.50
Copperas, bgs., f.o.b., wks., ton	17.00 - 18.00
Copper carbonate, bbl., lb.	.24 - .27
Sulphate, bags, 100 lb.	7.60 - 7.75
Cream of tartar, bbl., lb.	.38½- .40
Diethylene glycol, dr., lb.	.15 - .16
Epsom salt, dom., tech., bbl., 100 lb.	2.30 - 2.60
Ethyl acetate, tanks, lb.	.12 - .18
Formaldehyde, 30%, dr., wks., lb.	.0545-
Furfural, tanks, lb.	.09½-
Glaubers, salt, bag, 100 lb.	1.25 - 1.50
Glycerine, c.p., drums, extra, lb.	.39 - .40
Lead:	
White, basic carbonate, dry, casks, lb.	.16 -
Red, dry, sck., lb.	.176- .18
Lead acetate, white crys., bbl., lb.	.19½- .20½
Arsenate, powd., bags, lb.	.21½- .22
Lithopone, bags, lb.	.06 - .06½
Magnesium carb., tech., bags, lb.	.07½- .08
Methanol, 95%, tanks, gal.	.60 -
Synthetic, tanks, gal.	.24 - .29
Phosphorus, yellow, cases, lb.	.26 - .27
Potassium bichromate, bags, lb.	.11½- .11½
Chlorate, powd., lb.	.09 - .09½
Hydroxide (caustic potash) dr., lb.	.0785- .09½
Muriate, 60%, bags, unit	.37½- .45½
Nitrate, ref., bbl., lb.	.10½- .12
Permanganate, drums, lb.	.21½- .22
Prussiate, yellow, casks, lb.	.19 - .20
Sal ammoniac, white, casks, 100 lb.	4.75 - 5.00
Salsoda, bbl., 100 lb.	1.10 - 1.20
Salt cake, bulk, ton	20.00 - 25.00
Soda ash, light, 58%, contract, bags, 100 lb.	1.30 -
Dense, bags, 100 lb.	1.38 -
Soda, caustic, 76% solid, drums, 100 lb.	2.85 -
Acetate, del., lb.	.05½- .06
Bicarbonate, bags, 100 lb.	2.25 - 2.75
Bichromate, bags, lb.	.09 - .09½
Bisulphate, bulk, ton	20.00 - 24.00
Bisulphite, bbl., lb.	.03½- .04

Do you see the answer to your bulk material handling problem here?

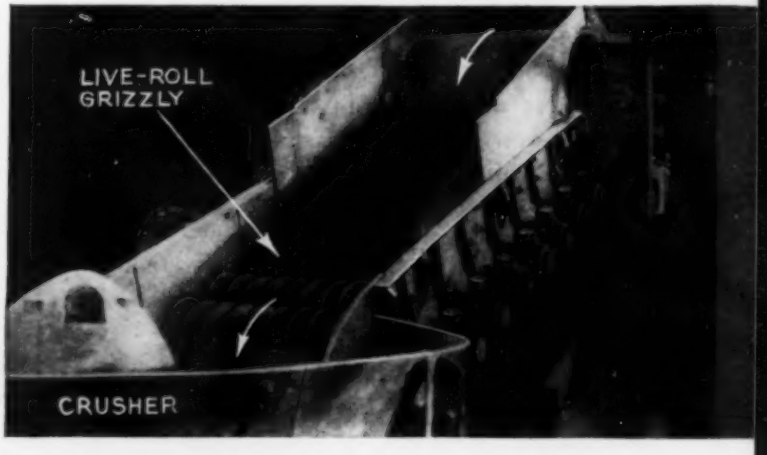
One of hundreds of Stephens-Adamson engineered coal conveyor systems. This one has unloaded, stored, screened and delivered 300,000 tons of coal a year since 1926 with practically no repairs. Similar systems are cutting costs of handling aggregate, ore and other bulk materials. Each system is specially engineered for the job—easy for S-A because S-A makes all types of conveying equipment and accessories—S-A can use the exact type of equipment the job requires.



Feeding coal to boiler hoppers is a job made-to-order for an S-A engineered REDLER Conveyor System. Sealed casings eliminate coal dust. Inherently compact, REDLER systems save space, reduce need for bulky equipment. They move bulk materials fast in a solid mass horizontally, up, down, around corners, anywhere. A perfect example of low-cost handling with the right equipment engineered into the right system.



When absolute cleanliness without disturbance of balance of mixed ingredients is needed, S-A REDLER Conveyor-elevator Systems get the call. The system shown here conveys food ingredients, distributes the mixture to battery of packaging machines. Sealed casings prevent contamination, eliminate waste from spillage. S-A engineered REDLER Systems are in wide use in the food processing and chemical fields . . . can be engineered to meet virtually any bulk material handling problem.



Special handling problems are readily solved by S-A engineers with their unlimited access to the right equipment, all built by S-A. Here you see an S-A Live Roll Grizzly used to feed large lumps of ore to crusher, while passing fines through to belt conveyor below. What's your handling problem? Difficult? Involved? Talk it over with S-A engineers. Let them show you how the right equipment, engineered into the right system can provide the efficient, economical answer.

STEPHEN S-A ADAMSON MFG. CO.

3 RIDGEWAY AVENUE, AURORA, ILLINOIS — LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

Newark

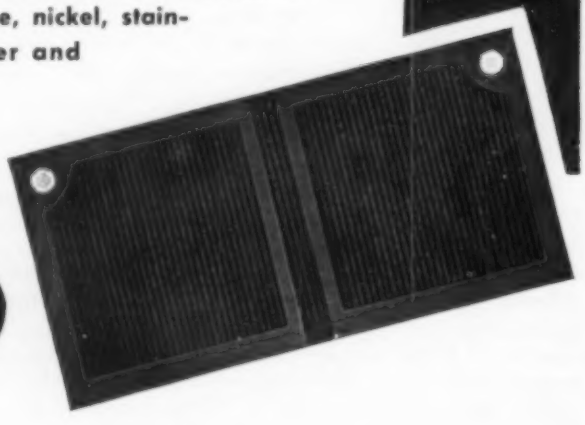
ACCURATE MESH

DURABLE WEAVE

METALLIC FILTER CLOTH

Newark metallic filter cloth is ideally suited for use in the process industries. It is woven firmly and uniformly with carefully selected and annealed wire and has the special Newark overlap weave for strength and exceptionally long service life.

Newark metallic filter cloth is available in the finest of meshes, in metals such as aluminum, brass, Monel, nichrome, nickel, stainless steel, gold, silver and platinum, in rolls or cut to fit your requirements.



NEWARK for ACCURACY

Newark Wire Cloth COMPANY

350 VERONA AVENUE • NEWARK 4, NEW JERSEY

CHEMICAL ENGINEERING
Weighted Index of Prices for OILS & FATS

Base = 100 for 1937

As for February 1	291.41
Last month (Revised)	293.04
February, 1947	317.78
February, 1946	145.68

Chlorate, kegs, lb	$0.07½	$0.08
Cyanide, cases, dom., lb	.14½	.15
Fluoride, bbl., lb	.09½	.09½
Hyposulphite, bags, 100 lb	2.75	3.15
Metasilicate, bbl., 100 lb	3.40	4.00
Nitrate, bulk, ton	37.00	48.00
Nitrite, casks, lb	.06½	.07
Phosphate, tribasic, bags, 100 lb	3.40	4.00
Prussiate, yel., bags, lb	.12	.12½
Silicate, 40°, dr., wks., 100 lb	1.00	1.05
Sulphite, crys., bbl., lb	.03	.04
Sulphur, crude at mine, long ton	16.00	18.00
Dioxide, cyl., lb	.085	.09
Dioxide, tanks, lb	.044	.....
Tin crystals, bbl., lb	.67	.....
Zinc chloride, gran., bbl., lb	.07	.07½
Oxide, lead free, bags, lb	.10	.10½
Oxide, 35%, leaded, bags, lb	.11½	.13
Sulphate, bags, cwt	4.15	7.00

OILS AND FATS

Castor oil, No. 3 dr., lb	0.27½	.....
Chinawood, oil, tanks, lb	.26	.....
Coconut oil, Ceylon, N. Y., lb	.25	.....
Corn oil, crude, tanks (f.o.b. mill), lb	.29½	.....
Cottonseed oil, crude (f.o.b. mill), tanks, lb	.26½	.....
Linseed oil, raw, car lots, dr., lb	.328	.....
Palm, casks, lb	nom.	
Peanut oil, crude, tanks (mill), lb	.26½	.....
Rapeseed oil, refined, bbl., lb	nom.	
Soybean, tanks, lb	.24½	.....
Menhaden, light, pressed dr., lb	.27	.....
Crude, tanks (f.o.b. factory), lb	.22	.....
Grease, yellow, loose, lb	.21½	.....
Oleo stearine, lb	nom.	
Oleo oil, No. 1, lb	.32	.....
Red oil, distilled, bbl., lb	.31½	.....
Tallow, extra, loose, lb	.22½	.....

COAL TAR PRODUCTS

Alpha-naphthol, crude, bbl., lb	$0.64	$0.66
Alpha-naphthylamine, bbl., lb	.35	.36
Aniline oil, drums, lb	.14	.15
Aniline salts, bbl., lb	.22	.24
Benzaldehyde, tech., dr., lb	.45	.50
Benzidine base, bbl., lb	.77	.78
Benzoic acid, USP, kegs, lb	.54	.56
Benzol, 90% tanks, works, gal	.21	.....
Benzyl chloride, tech., dr., lb	.20	.21
Beta, naphthol, tech., drums, lb	.26	.27
Cresol, USP, dr., lb	.17	.18
Cresylic acid, dr., wks., gal	1.25	1.30
Diphenyl, bbl., lb	.15	.16
Diethylaniline, dr., lb	.48	.50
Dinitrotoluol, bbl., lb	.18	.19
Dinitrophenyl, bbl., lb	.26	.27
Dip oil, 15%, dr., gal	.23	.25
Diphenylamine, dr., f.o.b. wks., lb	.25	.....
H. acid, bbl., lb	.50	.52
Hydroquinone, bbl., lb	.90	.95
Naphthalene, flake, bbl., lb	.12	.13
Nitrobenzene, dr., lb	.08½	.09
Para-cresol, bbl., lb	.41	.60
Para-nitroaniline, bbl., lb	.42	.43
Phenol, USP, tanks, lb	.11½	.12
Picric acid, bbl., lb	.30	.32
Pyridine, dr., gal	2.50	2.55
Resorcinol, tech., kegs, lb	.68	.70
Salicylic acid, tech., bbl., lb	.30	.35
Solvent naphtha, w.w., tanks, gal	.27	.....
Toluidin, bbl., lb	1.00	.....
Toluol, drums, works, gal	.35	.....
Xylol, com., tanks, gal	.28	.....

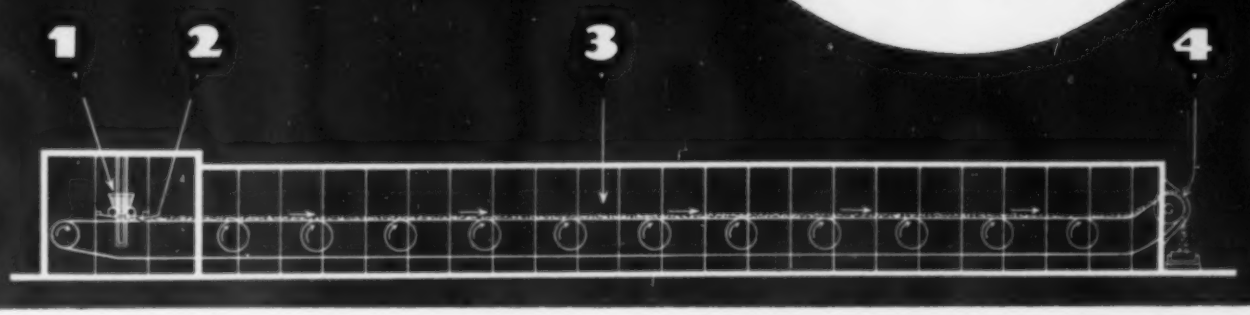
MISCELLANEOUS

Casein, tech., bbl., lb	$0.31	$0.33
Dry colors:		
Carbon gas, black (wks.), lb	.04	.07
Prussian blue, bbl., lb	.42	.43
Ultramarine blue, bbl., lb	.13	.24
Chrome green, bbl., lb	.32	.42
Carmine red, tins, lb	5.50	6.00
Para toner, lb	.80	.95
Vermilion, English, bbl., lb	2.50	2.70
Chrome yellow, C. P., bbl., lb	.26	.28
Gum copal, Congo bags, lb	.09	.55
Manila, bags, lb	.09	.15
Damar, Batavia, cases, lb	.10	.22
Kauri, cases, lb	.18	.60
Magnesite, calc., ton	52.75	57.00
Pumice stone, lump, bbl., lb	.05	.07
Rosin, H., 100 lb	9.65	.....
Shellac, orange, fine, bags, lb	.64	.65
Bleached, bonedry, bags, lb	.64	.65
T. N. bags, lb	.63	.64
Turpentine, gal	.77	.....

RUBBER ACCELERATOR

DRIED TO MOISTURE CONTENT OF 0.3% (B.D.W.B.*) AT RATE OF 1200 POUNDS PER HOUR IN PROCTOR CONTINUOUS CONVEYOR SYSTEM

*Bone Dry Weight Basis



In one typical installation of a Proctor continuous conveyor dryer combined with a preforming feed, a rubber accelerator is being dried absolutely uniformly and at a high hourly rate. In handling this product in the Proctor system here is what takes place: ❶ Material is mechanically dewatered by means of a continuous filter, the product is deposited into the hopper of the Proctor rolling extruder feed with a moisture content of 184% (B.D.W.B.). ❷ Coming to the feed in this state, the material is forced through a perforated plate by rolls moving back and forth, and deposited onto the conveyor of the dryer in spaghetti-like extrusions. This particular feed was recommended for this application because the physical characteristics of the product were such that it would hold a definite shape after extrusion. ❸ Loaded to a uniform depth on the moving conveyor, the product is conveyed through the drying chambers, where heated air is circulated through the bed of material on the conveyor. Temperatures are 230° F. in the first zone; 250° F. in the second, and reduced to 230° F. in the final zones. Having been reduced to small, uniformly thick shapes, it is possible for rapid diffusion to take place, which results in more rapid and uniform drying of the finished product. ❹ After 101.5 minutes of drying time, the rubber accelerator, uniformly dried to a moisture content of 0.3% (B.D.W.B.) is discharged from the dryer at the rate of 1200 pounds (C.D.W.†) per hour.

This installation is but one of many individually designed Proctor drying systems—each for specific product and output requirements. Only after careful research and study will Proctor engineers make recommendations on a system for any particular application. Once these recommendations are made, however, you have the assurance—written into the sales contract—that the system will meet your needs in every detail. That is why it pays not only to consult Proctor engineers—but to consult them early in your consideration of a drying system. If you have a problem in the drying of a wet solid, write us about it today.

†Commercial Dry Weight

New Proctor Booklet on Case Histories

If you have not already reviewed the latest Proctor booklet on wet solid drying—write for your copy of "11 Chemical Drying Problems Solved By Proctor Research." You'll find it informative and rather conclusive evidence to support our advice that you consider drying problems carefully—and early.

Proctor & Schwartz, Inc. *Philadelphia 20, Pa.*

NEW CONSTRUCTION

	Current Projects		Cumulative 1948	
	Proposed Work	Contracts	Proposed Work	Contracts
New England				
Middle Atlantic	$2,000,000	$250,000	$2,000,000	$2,511,000
South	13,892,000	1,137,000	20,492,000	2,887,000
Middle West	800,000	478,000	1,025,000	946,000
West of Mississippi	6,475,000	930,000	6,950,000	8,309,000
Far West	7,500,000	1,040,000	9,000,000	1,682,000
Canada	10,000,000	4,750,000	11,500,000	5,125,000
Total	$40,667,000	$8,585,000	$50,967,000	$21,460,000

Proposed Work

Calif., Bakersfield—Standard Oil Co. of California, 225 Bush St., San Francisco, plans to enlarge its oil refinery. Estimated cost $7,500,000.

Fla., Starke—E. I. du Pont de Nemours & Co., Inc., du Pont Bldg., Wilmington, Del., plans to construct an ilmenite processing plant here. Estimated cost $1,000,000.

Ga., Atlanta—Standard Oil Co., 746 Marietta St., N. W., plans to construct shops, storage plant, etc. Estimated cost $800,000.

Kan., Coffeyville — Consumers Cooperative Assn., Coffeyville, plans to construct a dewaxing plant. Estimated cost $1,750,000.

La., Baton Rouge—Ethyl Corporation, Baton Rouge, plans to construct a complete development laboratory and pilot plant building. Badman & Murrell, 713 Raymond Bldg., Baton Rouge, Archts.

Miss., Greenville — Nitric Manufacturing Plant c/o M. T. Reed, Belzoni, Miss., plans to construct an ammonium nitric and nitric acid plant and an ammonia plant (fertilizer manufacturing) in this area. Robert Hand, Mississippi Agricultural College and Industrial Board, Greenville, Cons. Eng. Estimated cost $1,951,000 and $10,073,000.

Mont., Billings—North Star Refining Co., Billings, plans to construct an oil refinery. Estimated cost $250,000.

N. Y., Buffalo—Allied Chemical & Dye Corp., 61 Broadway, New York, N. Y., plans to construct a plant for the manufacture of industrial chemicals on River Rd., Tonawanda Township. Estimated cost several million dollars.

Pa., Indiana—McCreary Tire & Rubber Co., Indiana, is having plans prepared by Franklin, Douden & Assoc., 522 Century Bldg., Pittsburgh, for the construction of a 1 story, 125x162 ft. warehouse. Estimated cost $800,000.

Tex., Galena Park—Dumax Corp., Galena Park, plans to construct a chemical manufacturing plant. Estimated cost $100,000.

Tex., Houston—Hart & Burns, San Diego, Calif., and 210 North Preston St., Houston, plans to construct a 1 story paint manufacturing plant (initial unit) and also an additional unit after completion of first unit. Estimated cost $200,000 and $175,000 respectively.

Tex., Houston—Standard Rendering Co., 635 Adams St., Kansas City, Mo., plans to expand its rendering plant to take unused fats and manufacture into fertilizer and products for soap manufacture. Estimated cost $325,000.

Tex., Levelland—Stanolind Oil & Gas Co., Gulf Bldg., Houston, plans to construct a natural gasoline plant. Estimated cost $3,000,000.

Tex., Pasadena — Crown Central Petroleum Corp., c/o Union National Bank Bldg., plans improvements to its gasoline refinery. Estimated cost $250,000.

Tex., Portland—Louis Wohinc c/o Plymouth Oil Co., Portland, and Weston, W. Va., plans to construct a glass manufacturing plant here. Estimated cost $275,000.

Tex., Texas City—Petrol Terminal Corp., Texas City, plans to expand its refinery including a distillation unit. Estimated cost $150,000.

N. B., Duncan Bay—Canadian Western Timber Co., Ltd., Vancouver, plans to construct a pulp mill. Estimated cost $10,000,000.

Contracts Awarded

Calif., San Jose—Mun-Dell Paper Co., 79 North Market St., has awarded the contract for a 100x240 ft. paper plant to Carl N. Swenson Co., Box 558, San Jose. Estimated cost $72,000.

Calif., Oakland—Owens-Illinois Glass Co., 601 36th Ave., has awarded the contract for a plant addition to Monson Bros., 475 6th St., San Francisco.

Fla., Jacksonville—National Container Corp., 4300 Talleyrand Ave., will construct two additions to its paper mill, a radial brick chimney and a precipitator for recovery building. Work will be done by owners. Estimated cost $387,000.

Ill., Chicago—J. M. Huber Corp., 620 62nd St., Brooklyn, N. Y., has awarded the contract for an ink factory to Ragnor Benson, Inc., 4744 West Rice St. Estimated cost $250,000.

Kan., Topeka—Snyder Chemical Co., National Bank of Topeka, has awarded the contract for a 1 story, 80x120 ft. plant to Bowers Construction Co., 627 College St. Estimated cost $70,000.

Ky., Louisville — Brown-Forman Distillers Corp., c/o Joseph & Joseph, Archts., Louisville, has awarded the contract for the construction of a bottling plant to George H. Rommel Co., 958 Logan St., Louisville. Estimated cost $750,000.

Md., Baltimore—Brooklyn Chemical Works, Inc., 9th and Patapsci Sts., Curtis Bay, has awarded the contract for an addition to its plant to Baltimore Contractors, Inc., 711 South Central Ave. Estimated cost $250,000.

Mich., Detroit—Pennsylvania Salt Co., 4655 Biddle Ave., Wyandotte, has awarded the contract for the construction of a warehouse to Cunningham-Rudy Co., 3087 West Grand Blvd. Estimated cost $160,000.

N. M., Jal—El Paso Natural Gas Co., El Paso, Tex., will construct an additional dehydration plant unit. Work will be done by owners. Estimated cost $325,000.

Tex., Amelia—Sun Oil Co., Beaumont, has awarded the contract for a shop, laboratory and office building here to Austin Co., Second National Bank Bldg., Houston. Estimated cost $300,000.

Tex., Brenham—Brenham By-Products Co., c/o L. J. Linenberger, San Angelo, will construct a rendering plant for fats, protein feed and hide curing. Work will be done by subcontracts and force account. Estimated cost $70,000.

Tex., Houston—Gulf Oil Corp., Box 2100, has awarded the contract for a 2 story, 65x135 ft. laboratory to R. E. Sullivan Co., 821 First Natl., Bank Bldg., Houston. Estimated cost $165,000.

Wash., Tacoma—St. Regis Paper Co., Tideflats, will construct a 72x612 ft. paper mill. Work will be done by owners. Estimated cost $900,000.

Wis., Green Bay—Hoffer Glass Co., 322 Main St., has awarded the contract for a 1 story, 120x159 ft. warehouse to Sehner Co., Northern Bldg.

Ont., Hamilton—Appleford Paper Products, Ltd., G. F. Clark, Mgr., has awarded the contract for the first unit of its plant to Dalton Engineering & Construction Co., Ltd., 587 Fleet St., W. Toronto. Estimated cost $500,000.

Ont., Hamilton—National Paper Goods, Ltd., 144 Queen St., Q., has awarded the contract for an addition to its plant to Olmstead & Parker, 121 Shaw St. Estimated cost $125,000.

Ont., Hamilton—Procter & Gamble Co. of Canada, Ltd., Burlington St., E., has awarded the contract for two 4 story bays at its plant to W. H. Cooper Construction, Ltd., Medical Arts Bldg., Hamilton. Estimated cost $1,500,000.

Que., Gatineau—Commercial Alcohols, Ltd., 3176 Notre Dame St., E., Montreal, has awarded the contract for superstructures for new plant units to Anglin-Norcross Quebec, Ltd., 892 Sherbrooke St., W., Montreal. Estimated cost $2,500,000.